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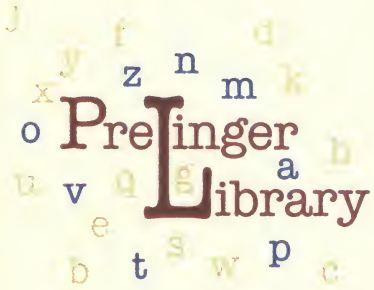

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STREET TRAFFIC CONTROL

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BY

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To the Memory
of My Father

PREFACE

The alarming increase in street accidents and in street congestion during the past few years has rendered the correction of traffic conditions one of the most important municipal problems of the present day. This book has been written in the hope that it will be of assistance to those who are trying to solve this problem. I have attempted to analyze the causes of existing street traffic difficulties, to summarize the experiences of the greater American cities, and to present the conclusions of the foremost practical experts.

While preparing this work for publication I have had the advantage of the counsel of Professors William Bennett Munro, and Arthur N. Holcombe of Harvard University. I am also indebted to the public officials and others who assisted me in making a survey of street traffic conditions in the principal American cities.

MILLER MCCLINTOCK.

LOS ANGELES, CALIF.
May, 1925

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STREET TRAFFIC CONTROL

CHAPTER I

THE ORIGIN AND GROWTH OF THE STREET TRAFFIC PROBLEM

THE ORIGIN

Streets have been called the arteries of the city, and the French refer to the traffic which moves through them as *circulation*. The burden which is carried by the streets of a great city, when analyzed is found to be the life blood of its economic and social life.

An urban community depends for its existence upon transportation facilities, in fact, the refinement and development of national and world commerce may be said to be one of the chief reasons for the growth of the greater cities. The transportation problem of a city has two aspects, external and internal. If a community is to prosper it must be connected with the rest of the world. The city dweller must be able to reach out to far-distant sources for his food supply and for the materials with which he works, and in turn he must depend upon transportation systems for the distribution of the commodities which he produces. This is the external aspect of the problem.

The internal transportation problem of the city is of equal importance. Urban trade neither originates nor ends at the outer limits of the city. Incoming commerce must penetrate to the heart of the community and from thence be distributed to every unit of the structure. Commodities which are made within the city must be collected and carried to their point of departure. From rail-head and wharf to home and factory; from home and factory to rail-head and wharf, the streets afford a necessary link in the transportation system which connects the city with the outside world. The postal system affords an example of the interdependence of the external and internal transportation facilities of the city. Train or steamer brings

the bulk to the city gates where it is broken into its component parts and diffused throughout the community, first by vehicles and finally by the pedestrian carrier. This process is typical of practically every commercial negotiation of the city. It would profit an urban community but little to be located on the finest of world highways if the density of its own structure made penetration of commerce to its parts impossible.

Street traffic represents not only an integral part of the external commerce of the city, but in its daily flow is to be found a reflection of the economic and social relations of its citizens. One writer has defined a city as "a large aggregation of people having a high degree of density and a facility for intercommunication."[1] The streets are the means for this intercommunication, and without them no city could exist for a single day. A corollary is equally true that when the streets fail to meet the increased demand which is placed upon them the growth of the community will be limited.[2]

THE GROWTH OF THE TRAFFIC PROBLEM

The street traffic problem is by no means new. Ancient cities as well as modern suffered from street congestion. In Rome, "Caesar found it necessary to issue an order prohibiting the passage of wagons through the central district for 10 hours after sunrise"[3]—a more stringent regulation than any modern city has been forced to pass. Medieval cities, hemmed in by their defensive walls, and provided with narrow and crooked lanes for streets, found wheel traffic practically impossible.

The modern traffic problem arose in the latter part of the past century, and is a by-product of the phenomenal growth of metropolitan districts. To the increase in population alone,

[1] HAYES, E. C., "Introduction to the Study of Sociology," p. 60, New York, 1915.

[2] BARTHOLOMEW, HARLAND, "A Major Street Plan for St. Louis," p. 2, St. Louis, 1917. "No finer example of the influence of good and bad street plans upon city life and growth can be found than in St. Louis. Along the river front from Spruce Street to Washington Avenue are the little old streets, 30 to 40 feet wide, . . . The extreme narrowness of these streets for modern city use has contributed probably as much as, if not more than, the decline of river traffic, to the apparent idleness which today distinguishes this part of our city."

[3] MUNRO, WILLIAM BENNETT, "Municipal Government and Administration," vol. I, p. 22, New York, 1923.

however, cannot be attributed the more important causes of the problem. The skyscraper and the motor car play the principal rôles.

The skyscraper provides a concentration point for a large number of persons without making provision for any increase in the capacity of the streets which are to carry them. The situation is graphically expressed by an eminent engineer: "We have built forty-story cities on a street plan designed for a three-story town."

The Coming of the Motor Car.—An analysis of the effect of the automobile on the problem is more complicated, involving the factors of numbers, speed, capacity, and safety.

The growth of the automobile industry may be dated from 1895, in which year 300 vehicles were produced. In 1923 the annual production had reached a total of 4,012,850.[1] This great increase in production, however, gives an imperfect idea of the number of vehicles in actual use. During this same period the registration of motor cars had increased from 300 in 1895, to 15,222,658 in 1923.

Registration figures for 1923 show five cities having a total of 1,451,829 vehicles or approximately as many as were produced in American factories in 1921. Of this total Los Angeles (county) claimed 426,935, New York City 363,590, Chicago 265,233, Detroit (county) 230,594, and Cleveland 165,477. In 1922 Dayton, Ohio, reported 1,885 motor vehicles per square mile, and twelve other cities of less than 100,000 inhabitants reported more than 1,200 vehicles per square mile.

[1] *Automotive Industries*, quoted in *New York Times*, sec. 20, p. 12, Mar. 2, 1924.

The following table is compiled from data in *Facts and Figures*, National Automobile Chamber of Commerce, New York, 1923:

Year	Production	Registration
1895	300	300
1900	5,000	13,823
1910	187,000	468,497
1920	2,205,197	9,177,129
1923	4,012,850	15,222,658

The ratio of automobiles to population is no less startling. In the country at large there are seven persons for each registered motor vehicle, while eleven states have a motor vehicle for every five persons in the state. In California every resident of the state could go for an automobile ride at the same time with no more than three persons in each vehicle.

Forecasts as to the future increase in automobile ownership is hazardous. The most widely accepted estimate of the saturation point is five-to-one, that is, one automobile for every five persons. The fact that eleven states have already reached this ratio, and that four cities and two states have exceeded it, makes it appear that the estimate of five-to-one may be too conservative. Prosperity of the masses, the ability of manufacturers to lower prices, the future cost of fuel, and a continued freedom from heavy taxation, all play a part in the forecast.

Physics as well as economics, however, serves to determine the number of automobiles which can use the city streets. At the point where the motor vehicle, by the mere weight of its own numbers, ceases to be a convenient method of transportation, there is found an inclination on the part of owners to cease to use their cars in city traffic. This reaction is apparent in all of the larger communities. If all the owners of motor cars who have business in the congested district of any great city should attempt to drive to their work on the same day an impossible congestion would result. With future registrations which may be expected it is certain that in the major city streets at peak hours the density of traffic will always approach a point of complete saturation. Hence any reasonable increase in street capacity, either through a more rapid movement of traffic, or through a widening of the thoroughfare, will not reduce the density of traffic, for the places thus made available, will be taken by those drivers who may be said to be on the margin of convenience, that is, those who under the improved conditions find street travel barely convenient enough to warrant their utilizing it in preference to other means of transportation.[1]

[1] *New York Times*, sec. 2, p. 1, Oct. 21, 1923. Statistics of this movement in street use are not available. The principle, however, is illustrated by the report of the New York Rapid Transit Commission for the year ending June 30, 1923. The rapid transit lines, elevated and subway, entering Manhattan, showed an increase of 72,122,104 revenue passengers, while the street surface lines showed a decrease of 5,148,270.

The minimum convenience which will attract individuals to use the streets will be determined by the importance of their travel, and more especially by their ability to use other means of transportation which may offer greater convenience.[1]

The Passing of the Horse.—Motorization has not only increased the number of vehicles on the streets but it has revolutionized the character of traffic by increasing the rapidity of movement. Instead of a current capable of moving at a rate of speed materially less than 10 miles per hour, there is now found a current limited in speed only by the number of vehicles on the street, and by the requirements for safety.

The horse-drawn vehicle is rapidly disappearing. New York affords an interesting example. In 1918, 13,387 public horse-drawn carts were licensed. In 1919, the number was 13,017; in 1920, 12,810; in 1921, 9,782; and in 1922 the number had decreased to 8,661.[2]

On Feb. 7 and 8, 1923, the Joint Traffic Committee of the Boston Chamber of Commerce, made a count of all daylight traffic passing three important intersections. The count showed a total of 33,861 vehicles of all types of which only 1,266 were horse-drawn.

If the present tendency continues it is safe to predict that within a few years the horse-drawn vehicle will have disappeared entirely from city streets. From the standpoint of traffic flow this will be a great advantage. While the automobile has thrown a great burden of numbers on the streets, it has tripled, at a conservative estimate, their per hour capacity because of its greater speed.

The Effect of Motor Traffic on Street Capacity.—The use of the private passenger automobile is the reverse of the almost universal tendency toward the use of vehicles of greater capacity, as illustrated in the practice of all rail carriers. The motor car has tended to make the individual more mobile, but in accomplishing the end it has made it necessary for him to occupy a greater street area than he would as a passenger in a common carrier.[3] In a report submitted to the Boston Chamber of

[1] Triggs, Inigo, *Town Planning*, p. 140, London, 1909.

[2] Littledale, Harold A., *New York Evening Post*, Mar. 19, 1923.

[3] *Electric Railway Journal*, pp. 77–78, Jan. 13, 1923. "During the evening rush hour in Baltimore it was found that in the downtown streets, where both street cars and automobiles were operated, 73 per cent of the total

Commerce it is estimated that each person in a loaded five-passenger automobile is using seventeen times as much street space as each person in a completely filled street car.[1] Although the automobile moves somewhat more rapidly than does the street car, the greater economy of the latter is marked.

While the motor car increases the burden on the street per passenger carried as compared with the street car, the motor truck tends to reduce the street burden per ton of goods carried as compared to the horse-drawn vehicle which is its only rival in carting. This is chiefly due to the smaller street space occupied by the truck, its greater capacity,[2] speed, and facility of movement. The substitution of the motor truck for the horse-drawn truck and delivery wagon means a very great relief to congestion.[3] A similar relief is brought about by the introduction of the large capacity passenger busses of the Fifth Avenue type.[4]

The Increase in Street Hazards.—Taken as a whole the motorization of traffic has undoubtedly added greatly to street capacity. It has brought with it, however, a problem of the most serious character—that of street hazards.

The total of fatalities resulting from automobile accidents is startling enough, but the situation is rendered more disturbing by two elements. The first is that, of all vehicles, the motor car continues to be an increasing menace to human life. Automobile fatalities increased in the registration area from a rate of 4.4 per million of population in 1906 to a rate of 93.6 in 1919, and to a rate of 149 in 1923, while railway fatalities decreased

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movements were by automobiles which accommodated 11.2 per cent of the total passengers, while 88.8 per cent of the passengers were taken care of by the street cars which occupied only 17 per cent of the traffic space."

[1] IRELAND, MAJOR MARK L.

[2] *Facts and Figures*, p. 11, New York, 1923. National Automobile Chamber of Commerce. Of the 252,668 trucks produced in 1922, 75.5 per cent were of 1-ton or greater capacity.

[3] WHITTEN, R. H., *American City*, vol. 23, p. 352.

[4] F. T., WOOD, President and General Manager of the Fifth Avenue Coach Company informs the writer that the single-deck busses operated by the company have a seating capacity of from fifteen to thirty passengers, and that the double-deck busses seat from fifty upwards. In the fiscal year ending June 30, 1923 more than 50,000,000 passengers were carried. Large capacity busses of the Fifth Avenue type are now being used in Baltimore, Pittsburgh, Detroit, Chicago, and St. Louis.

from a rate of 168.9 per million of population in 1906 to 74.0 in 1919. Similarly street railway accidents decreased from a rate of 35.4 per million in 1906 to 22.5 in 1919. Fatalities from all other vehicles combined decreased from a rate of 36.3 per million of population in 1906 to a rate of 31.5 in 1919.[1]

The other element which causes the statistics of automobile fatalities to have a special significance is the rapidity with which the number of fatalities increases from year to year. In 1906 automobiles caused 374 deaths; in 1910 the total had risen to 1,681; in 1915 to 5,864; in 1920 to 11,068, and in 1922 to 13,875.[2]

The motor car has become the greatest public destroyer of human life. It has made the street the most dangerous place in the city. This is of particular significance inasmuch as the hazard which has been created is one which it is difficult to avoid. The cautious citizen is able to avoid condemned structures and fire traps once they have been pointed out to him. He must, however, use the streets, and face the dangers which they present if he is to carry on his business and social activities.

It is estimated by the Committee on Public Accident Statistics of the National Safety Council that during the year 1922, the daily accident fatalities totaled 206. Of this number thirty-eight were caused by automobiles; thirty-five by falls; nineteen by drownings; sixteen by burns; nine by machinery accidents; five by street car accidents; and the remainder by a varied assortment of special hazards.

The problem of safety on city streets is rendered more pressing by the fact that accident statistics show streets to be much more dangerous than rural highways. The automobile fatality rate has uniformly been nearly 50 per cent higher in urban districts than in the total registration area. The special hazard which the automobile creates on the city streets is emphasized by the fact that the fatal accidents from all other vehicles have been about the same in the urban as in the total registration area.

In 1918 there were 4,903 fatal automobile accidents in cities of 10,000 or more population in the registration area of the United States, establishing a death rate of 127.2 per million of population. During the same period in the rural districts of the registration states, exclusive of cities of 10,000 or more population, there were

[1] Crum, Frederick S., "Automobile Fatalities," p. 3, Newark, 1920.

[2] *Warning of Public Accident Statistics*, Chicago, 1923, figures taken from Crum, and National Safety Council.

2,308 deaths by automobile, establishing a rate of 56.8 per million of population. A committee on statistics acting under the Secretary of Commerce estimates that in 1923 not less than 22,600 persons were killed, and not less than 678,000 were injured in traffic accidents throughout the country.

The magnitude of the problem and something of its growth is indicated by the fact that in 1922 in Chicago alone more people were killed by automobiles than were killed by the same cause in the entire continental United States in 1907. In 1922 there were one hundred more fatal automobile accidents on the streets of New York than in the entire country in 1908.

RANK	GROUP	ESTIMATED POPULATION FOR JULY 1, 1923	TOTAL AUTO FAT. 1923	AUTOMOBILE FAT. PER 100,000 POPUL'N.
1.	50,000 TO 100,000	4,501,783	634	14.08
2.	100,000 TO 200,000	5,386,954	781	14.50
3.	200,000 TO 500,000	6,588,330	1126	17.09
4.	500,000 OR MORE	17,725,036	3261	18.40
GRAND TOTAL		34,202,103	5802	16.96

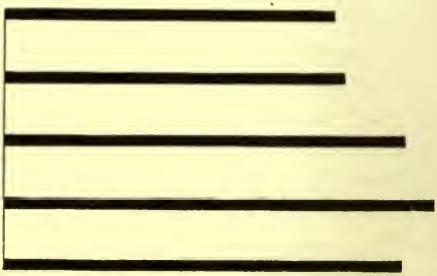

FIG. 1.—Urban automobile fatalities—1923. For the above chart the writer is indebted to Lew Palmer

An incorrect impression is obtained if the figures of automobile fatalities are considered without bearing in mind the increase in automobile registration. While it is true that there has been a staggering increase in the death rate per unit of population it is a significant and hopeful fact that the death rate per car in use has declined. In 1913 the death rate per 10,000 cars was 30.5; in 1915 the rate had declined to 24.0; in 1920 to 12.0; and in 1923 to 10.6. This decline indicates that the automobile has become a safer instrument of transportation, and that the chief cause for the increase in the total number of deaths is due to increased registration. If the steady decline in the death rate per car continues it is reasonable to anticipate that the death rate per unit of population will cease to increase and possibly decline when the saturation point of automobile ownership is reached.

A Suggested Approach to the Problem.—An analysis of the growth of the traffic problem in numbers and in hazards indicates that there are two elements which must be considered in an attempt to bring about its solution. Free and rapid movement of persons and commodities over the city streets is essential for the prosperity of the community, but this necessity for rapidity of movement must always be counterbalanced by the even greater necessity to protect the lives of those who use the streets. Some injuries and fatalities must always be anticipated from mechanical transportation systems. The consideration, however, of the present hazards as a necessary by-product of the motorization of traffic is fatal to a proper approach to the problem. Cities which have seriously faced the problem have proved that rapidity of movement, adequately regulated, is not incompatible with a large degree of safety. In its ultimate analysis, any type of movement or rate of speed which results in hazards of a serious nature, defeats its own purpose. The economic value of time and life lost through accidents, and increased insurance premiums where hazards are created, tend to offset any superficial economies which appear to result from unsafe speed of movement.

The failure of cities to cope more satisfactorily with the street situation which faces them is to be partially explained by the rapidity with which the traffic problem has descended upon them. While its growth began with the motorization of traffic the pressure of the new burden and its ultimate development were not generally realized until recent years. For example, practically all traffic bureaus of city police departments had their origin between 1910 and 1920.

These bureaus have done effective work, and in a few cities have succeeded in developing a certain amount of technique. They have been seriously hampered, however, by a lack of proper training, by an inadequate personnel, and by an inability to act effectively because of the limitations placed by police duties. The police have served, and will continue to serve chiefly as agents for the enforcement of orders which have been made for them.

These orders and regulations respecting traffic have had their origin in ordinances passed by councils of the municipalities, and in the more general vehicle codes of the states. Without anticipating the fuller discussion of these codes which is to follow,[1] it

[1] See chap. XI.

may be said that in most cities the traffic regulations have failed to keep pace with the problem, and that with rare exceptions they have been passed as a result of opinion rather than as a result of knowledge regarding the actual needs. Each state and city has made its vehicle code with but slight regard for the actions of adjacent jurisdictions. Cities have generally been granted such freedom that there is often a marked lack of uniformity of regulation between cities of the same state.

Despite the rapidity of traffic increase, and the many complexities which it involves, it is believed that the problem does not present insuperable difficulties. The time was when American cities were ridden with an annual epidemic of typhoid fever. Many considered the resulting fatalities as a necessary concomitant of urban life. The development of the science of municipal sanitation has shown the error of this view. Today cities are freed from the terror of typhoid, for they are provided with an ample supply of pure water, and their wastes are disposed of in an inoffensive and sanitary manner. Such a change has been made possible by the application of engineering skill to a problem demanding scientific knowledge. That the traffic problem is susceptible to a similar treatment is not to be doubted.

CHAPTER II

THE TRAFFIC SURVEY

An accurate and comprehensive knowledge of the traffic needs of a city must be obtained before suitable plans can be formulated. The opinions of casual observers have often been helpful in assisting a city with its street problems, but more frequently plans and methods based upon such information have been found useless or worse than useless. The traffic system of a great city is of such magnitude and of such complexity that even the trained observer finds that he has need for exhaustive study before he can advance proposals of a satisfactory nature. It is in answer to this need for definite data that the traffic survey is undertaken.

Each city has its own peculiar problems and it is impossible to suggest detailed methods of investigation which will answer all requirements. There are a number of factors, however, which are of universal significance, and without a thorough understanding of which no city can undertake, intelligently, to meet the demands of present and future traffic flow.

In its wider aspects a traffic survey should include all of the elements necessary for a clear understanding of the movement of persons and commodities over city streets. More specifically it should afford accurate information concerning the following factors: traffic flow, its volume, character, origin, and destination; population, its growth and distribution, with special attention to the regional distribution of automobile ownership; the existing street plan and future changes required to meet increasing volume of traffic; the standing vehicle, its relation to business and possibilities for its future disposition; methods of regulation and their actual effect on traffic flow; street hazards, their location and cause.

The purpose of this chapter is to set forth the methods for collecting information on these subjects which have been used successfully in American cities. The analysis of the factors themselves will be found in subsequent chapters.

A STUDY OF TRAFFIC VOLUME

The importance of the census of traffic flow lies in the fact that it gives a clear picture of what is actually taking place on the streets of the city. A knowledge of the increase in automobile registration serves as a partial indication of the growth of traffic, but it is only by actually counting the vehicles that the demand made upon the street system can be accurately estimated.[1]

All of the larger American cities have made traffic counts at various times, but there has been little attempt to make these counts of a uniform character, or at regular intervals. Thus, to a large extent, the comparative value which they might have is lost. A comprehensive traffic census cannot be made frequently because of the expense involved, but the importance of the problem in relation to the welfare and safety of the citizens, and the vital necessity for a clear understanding of its character, would seem to justify at least an annual investigation.

Conditions for the Count.—In order that the results of the periodic studies may be comparable they should be made as far as possible under similar conditions. Abnormal weather, for example, has a definite effect upon the volume of traffic and its behavior. The purpose of the count is to determine the typical average use of the streets, not the unusual or exceptional. Saturdays or similar days when the shopping and theater crowds place an abnormal demand on the streets, and Sundays or holidays when commercial traffic is light, are not representative days. Where possible the count should be taken on several normal week days, and the results averaged.

The time for the count is a matter to be determined by local conditions. In most cities it should begin with the start of the in-town rush in the morning and end with the completion of the out-town rush in the evening. In the larger cities where the *street day* is longer, provision is made for the early morning market and the evening theater traffic.

Location of Counters.—In determining the location of the posts from which the census is to be taken a consideration should

[1] The Bureau of Public Roads of the United States Department of Agriculture is at present perfecting a machine for weighing and counting vehicular traffic. It is as yet in the experimental stage, and while it gives satisfactory records for heavy vehicles there are some difficulties to be overcome in connection with the proper recording of high-speed, lightweight vehicles.

be given to the relation of the community to the surrounding region, and the layout of the traffic arteries within the city.[1]

Counting stations should be located on the main thoroughfares which past experience has indicated as the chief ways into the city, and at the point where they cross the city boundary. A census of vehicles entering and leaving a city serves the purpose of indicating the amount of street burden which can be attributed to traffic originating outside the city, and likewise establishes an intelligent basis for the coordination of city streets with rural highways.

Preliminary study of the movement of traffic will indicate the main channels which carry the heaviest burden into and out of the central portion of the city. At various points on these streets, especially where they are intersected by cross arteries, counters should be stationed. In this manner they will be able to observe and record practically the total flow of traffic exchanged between the downtown district, and the outlying residential and business portions of the city.

The East River bridges in New York, the Massachusetts Avenue bridge in Boston, and the Michigan Avenue bridge in Chicago are good examples of strategic points from which to make a traffic count.

Within the congested area consideration should be given to the volume of traffic passing the more heavily congested intersections. Indeed the movement of traffic through such intersections should be studied frequently, for they are in a manner the center of the entire traffic system of the city, and any failure on their part to function properly has widespread and serious effects. At such points the movement of traffic should be carefully analyzed, attention being given to the volume of traffic and notation made of the numbers of right- and left-hand turns.[2]

[1] In Los Angeles the Boy Scout Organization was used successfully and at slight cost to make a comprehensive traffic census of the entire city. See, "Major Traffic Street Plan," Los Angeles, 1923. Los Angeles Traffic Commission.

[2] HERBERT S., SWAN, *Engineering News-Record*, p. 405, Mar. 1, 1923, suggests the following points for a study of the "character and distribution of traffic at the intersections: (*a*) amount of traffic entering and leaving by the several approaches to the intersection; (*b*) volume of through traffic, cross traffic, right- and left-hand turns; (*c*) traffic density during maximum period; (*d*) origin and destination of traffic; (*e*) number and duration of periods street is open and closed to traffic from several directions; (*f*) speed

Pedestrians form an important part of the street burden in the congested area and greatly affect the problem of vehicular movement. While it does not appear necessary to make a special count of the flow of pedestrians into and out of the congested portion of the city it is important that something should be known of their movements within that district.

STUDY OF TRAFFIC CHARACTER

The character of the traffic flow as well as its volume is of importance and hence some provision must be made for a classification of the vehicles on the counting sheets. Many ingenious plans have been proposed, some including as many as a score of divisions. Simplicity in the tally sheet is a necessary element, for when vehicles are moving in large numbers and at even a moderate rate of speed it is impossible for a single observer to count the units and distribute them in a complex classification. A tally sheet which will be adequate can be arranged if the factors which must be considered are briefly analyzed.

Why is the vehicle on the street? If each driver could be questioned much valuable data would be obtained. This is obviously impossible. It is possible, however, to judge whether the vehicle is carrying passengers or commodities.

How much obstruction does the vehicle offer to traffic movement? Since this factor is to be determined chiefly by the speed at which the vehicle is capable of traveling, horse-drawn vehicles may be put into one class and motor vehicles into another. Practically all motor vehicles are capable of moving at the maximum legal rate of speed while horse-drawn vehicles are more limited.

What are the variations in traffic volume at different hours? The tally sheet should make provision for an indication of the time element. It is suggested that 15-minute intervals are most desirable for they reveal the more delicate fluctuations in the flow.

Finally provision should be made for a count of street cars and passenger busses, not only because of their effect upon the movement of other vehicles but because of the important part which they play in the daily transportation of persons.

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of several kinds of traffic; (*g*) turning radius of vehicles making right- and left-hand turns; (*h*) present traffic regulations; (*i*) possible improvements in traffic regulations; (*j*) comparative maximum traffic volumes under present and improved traffic regulations.

With the preceding requirements in mind a satisfactory tally sheet for the counter can be arranged as follows:

THE TRAFFIC CENSUS CHART

Counter's name		Location	Date		Totals
Time periods a. m.		6:00–6:15	6:15–6:30	6:30–6:45	
Passenger automobiles	In				
	Out				
Motor trucks.....	In				
	Out				
Horse-drawn vehicles.[1]	In				
	Out				
Street cars.....	In				
	Out				
Motor busses.....	In				
	Out				
Totals.....					

[1] It will be noted that no distinction has been made between the various types of horse-drawn vehicles. With few exceptions the horse-drawn carriage has become so rare that for the ordinary count it can be disregarded.

COMPILATION OF DATA

When the census has been completed for the entire city the question arises as to the method of summarizing and presenting the data in the most valuable manner. Actual traffic conditions are shown most clearly if the totals for the various control points be placed in their proper locations on the city map. This may be done in one of two ways. A circle, varying in size according to the volume of traffic, may be drawn around the control point and the figures indicating the total number of vehicles inserted. This plan was used by the Watch Committee of the City of

Manchester England, in their study of traffic conditions in 1914.[1] Another method, and by far the more graphic of the two, is to make a traffic flow map. This is done by superimposing on a map of the street system bands of color varying in width according to the total flow which each street has been found to carry. A simple map of this type is one in which the total number of vehicles of all types is represented by a band of one color. A

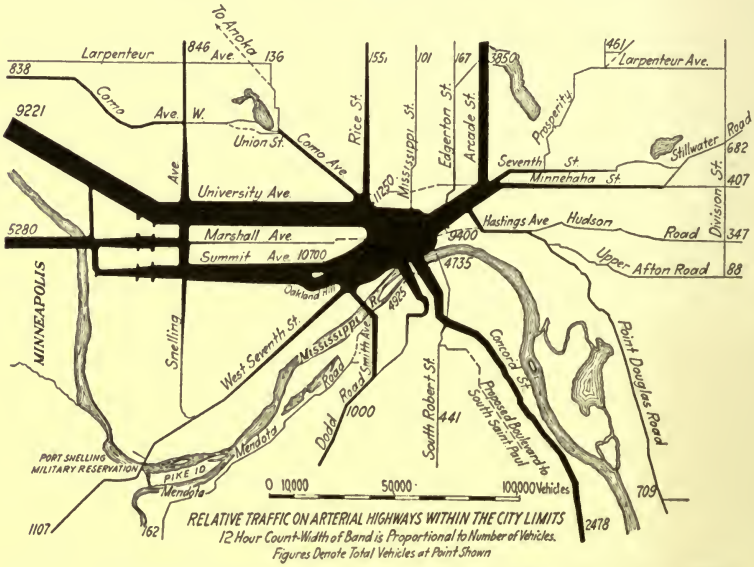

FIG. 2.—Traffic flow map. City Planning Board, *Plan of St. Paul*, 1922.

more analytical flow chart can be prepared from the census data by assigning a different color to each class of vehicles and adding it in its appropriate width to the flow diagram.

STUDY OF TRAFFIC SPEED

In addition to the study of the volume of traffic moving over a given street it may be found desirable to make a closer analysis of the behavior of the vehicles composing the stream. The speed of the flow as well as its quantity is of importance. The capacity of a street varies according to the rapidity of movement which it will permit as well as according to the number of lines which it will accommodate.

[1] "Traffic Congestion, Causes and Relief," Manchester, England, 1914.

Observations of speed may be made in several different ways. The simplest method is to have a motor car driven over a measured distance on a congested street, recording the time elapsed, thus making possible a computation of the average rate of speed possible to maintain on the street.

A more comprehensive and accurate speed study is that made according to the method used by Major R. F. Kelker, Jr., in an analysis of traffic movement on Michigan Avenue, Chicago. Yellow taxicabs were used as a basis for the study because of their easy identification. Observers were placed at street intersections from North Street to Thirty-first Street. The number of the cab and the time were recorded as the cabs passed the various control stations. The watches were checked and the tally sheets compared in order to get the elapsed seconds. From this information and knowledge of the distance between controls the speed in miles per hour was computed for each part of the street length.

Origin and Destination: Traffic Routes.—The traffic flow chart which has been discussed reveals a certain amount of information concerning the origin and destination of vehicles, for the diminishing width of the bands as they extend outward from the center of the community indicates something of the manner in which the burden is collected and distributed. A closer analysis of certain sections of the city or of certain streets may be found desirable. There are several ways in which this can be accomplished.

The Port of New York Authority made a one-day study of all trucking activities in lower Manhattan by the simple process of stationing observers at the entrances to wharves and terminals. When a truck arrived the driver was asked whence he came, and when he left he was asked his destination. The points of origin and destination were plotted on a map of the city, and lines were drawn connecting these points with those indicating the locations of the terminals. The resulting chart gave a graphic picture of the movements of heavier street traffic.

Another method is that used by the Under Forty Committee of the Boston Chamber of Commerce in their survey of traffic conditions in 1914. Strategic control posts were selected and a symbol assigned to each. Observers placed these symbols on passing vehicles using a different colored chalk for different periods of the day. Observers located at other points recorded

the time of the passage of the marked vehicles. In this manner the approximate routes followed by certain classes of vehicles were determined.

A simpler and perhaps more effective method is to have observers located throughout the congested district record on time charts (preferably divided into one-minute periods) the registration numbers of all automobiles passing their posts. These data when compiled and digested reveal the routes followed by the different vehicles, and definite information regarding their speed.

Such studies of origin and destination are valuable in that they indicate established community habits which are often the causes of unnecessary congestion. By such a study one city discovered that approximately one-fourth of the vehicles on the business streets had no business there, but were merely passing through from one part of the city to another. If the destination of such through traffic is understood it may be possible to by-pass it around the congested area.

STUDY OF POPULATION AND ITS DISTRIBUTION

Population studies have been made for practically every large American city. These provide the student of the traffic problem with a knowledge of the present distribution of population and indicate tendencies which will affect future distribution.

The traffic system of the city should serve not only the already present needs of the community, but should be planned in advance so that growth may be facilitated and directed along the most desirable lines. In the past the volume of street traffic has increased much more rapidly than the population of cities, in some cases with two or three times the rapidity.[1] It is believed, however, that when the saturation point in automobile ownership is reached—probably somewhere in the neighborhood of one vehicle for each five persons in the urban population—growth in the total traffic volume will increase in the same proportion as population increases. With this saturation point in mind

[1] WHITTEN, R. H., *American City*, vol. 23, p. 353. City passenger traffic has increased from two to three times as fast as population. On Fifth Avenue, N. Y. traffic increased 1.5 times as fast as population during the period 1885–1904, and 1.8 times as fast as population during the period 1904–1917.

and with a carefully worked out forecast of future increase in population it is possible to estimate with a fair degree of accuracy the demand which will be made upon the street system at any given time in the future.[1]

A consideration of the distribution of industries and of the population engaged in industrial pursuits assists in throwing light on probable traffic demands. The opening of new industrial sites, and the tendency of manufacturing plants to congregate in certain localities—a tendency often stabilized by zoning ordinances—should be taken into account in planning the future traffic system.

A consideration of the distribution of automobile ownership within the city is valuable as it shows in what parts of the city the daily flow originates. It is suggested that this information can be obtained most readily from the records of the motor vehicle departments which in many states publish lists of owners and addresses. Such data will have added significance and will serve to explain many questions if they are plotted on the traffic flow diagram which has already been discussed.

Census of Standing Vehicles.—The problem of the standing vehicle is without doubt one of the most perplexing phases of present-day street conditions. If drivers of vehicles did not need to stop when they reach their destination but could proceed immediately, traffic movement would be greatly simplified and a large amount of street space would be released for the use of moving vehicles. The need to stop, however, does exist. Normal travel over city streets is not an end in itself but merely a means to an end. The end cannot be accomplished by travel alone but must be accompanied by an opportunity to stop at least long enough to consummate that part of the driver's business which is immediately connected with the act of transportation.

Casual opinion has proved of little value in dealing with the problem of the standing vehicle. Recently a chamber of commerce in one of the larger American cities sent out a questionnaire. The merchants, numbering several hundred, who sent in replies were about equally divided in favoring limited, unlimited, and prohibited parking.

One factor in the problem is certain. At the present time there is a sufficient demand for standing space to fill all available

[1] See *Report of New Jersey Intertsate Bridge and Tunnel Commission*, p. 36, Trenton, 1920.

areas in downtown streets. Furthermore the practice of *double parking* is becoming so prevalent that at times many streets are rendered completely impassable.

The census of standing vehicles should be carried on under the same conditions as those indicated for the census of traffic flow, and where possible, simultaneously. The count should include in the first place an enumeration of all vehicles standing in the congested area at the time of the census. The method used by the Joint Traffic Commission of the Boston Chamber of Commerce in a study of the parking problem in that city is suggested as a useful one. The congested area of the city was divided into districts, and to each an observer was assigned. The street lengths, usually one side of a block, within the various districts were then numbered. The observer recorded the time, the number of the street length, and the number of cars which he found within it. By this method the count was completed within a few hours.

The aerial photograph affords an excellent way for obtaining information on the subject of standing vehicles. If taken at a sufficiently low altitude it reveals all parked automobiles and at the same time shows many interesting phases of traffic behavior and distribution. Such a photograph was prepared by the Automobile Club of Southern California and proved to be a valuable element in a report on street conditions in Los Angeles.[1]

The amount of the parking demand being understood some knowledge should be obtained regarding the character of the demand. The most significant point is the turnover, or in other words the average length of time cars are left at the curbing. Such a study is too complicated and time-consuming to carry on throughout the congested area, but typical data can be obtained by a consideration of selected street lengths. A method which has been used successfully for this study is that of having the registration numbers of parked automobiles in the area recorded at frequent intervals throughout the day.

Storage spaces other than the streets hold one of the most important promises for at least a partial solution of the standing vehicle problem. The capacities of private and public garages or storage lots will show the extent to which they may be used for relief. In San Francisco a study of this character revealed the fact that downtown garages were practically empty during the

[1] *A Report on Los Angeles Traffic Problems*, p. 9, Los Angeles, 1922.

daylight hours while the streets were so crowded with parked vehicles that movement was difficult.

A comprehensive parking survey will also include an estimate of the capacity of vacant pieces of land in or near the congested area which might be used for open-air storage lots. In some of the smaller American cities pieces of public land which are at present put to no use could be made to bear the greater part of the storage burden which is at present thrown upon the streets.[1]

The survey to this point deals chiefly with the factors of current and future demand. With the information in hand to estimate the demand which is now made upon the street system, and to forecast the future requirements, the surveyor logically turns his attention to the factors of supply. How nearly does the present traffic system satisfy the demand? What changes are necessary in order to increase adequately the capacity of the streets? The capacity of a street system depends on two elements: first, the character of the street layout; and secondly, the effectiveness of regulation. The two elements will be dealt with in turn.

Survey of the Street System.—Studies of the traffic street systems in various American cities have been made by city planning boards,[2] though in many cases the emphasis has been placed upon beauty, rather than upon convenience and utility from the standpoint of traffic movement.

The preceding study of traffic flow will have made possible a reasonably accurate estimate of the future demands, both with respect to volume and destination. The next step is the correlation of these data with the existing street layout. The flow map already prepared from the census of moving traffic serves as a good basis for this task. To the bands already placed on the map may be added the additional volume to be anticipated in the future, thus showing the amount and direction of traffic for which preparation must be made.

In practically all cases the present main traffic arteries will obviously be inadequate to carry this additional burden. Hence attention should be given to secondary thoroughfares and an estimate made of the amount of the total volume which can be

[1] Attention is called to the *Report of the Parking Survey Committee*, of the Los Angeles Board of Public Utilities, 1924.

[2] Attention is called to "A Major Street Plan for St. Louis," Bartholomew, Harland, St. Louis, 1917, and *A Report on a Major Traffic Street System for Los Angeles*, by Olmstead, Bartholomew, and Cheyney, 1924.

carried by them under improved conditions. Many secondary streets are not used to greater extent because their physical condition repels rather than attracts traffic. A careful location and study of such conditions merits the attention of the traffic engineer. Major changes and the construction of new thoroughfares are costly and should never be undertaken until full use has been made of existing streets.

The opportunity to make extensive improvements in the street system often depends upon the character and value of adjacent property. It will be found useful to obtain such information and indicate it on the traffic map.

Inasmuch as a zoning ordinance tends to determine to some extent the type and volume of traffic to be expected in any particular district in the future its provisions should be thoroughly understood and indicated on the map of the future street plan. The same provision holds true for plans which have been definitely accepted for the unification or shifting of passenger and freight terminals.

In some cities the full development of existing main and secondary thoroughfares will not suffice to carry the future traffic burden. An estimate of the surplus will indicate the capacity and location of new streets which must be provided.

Finally the survey of the street system may well include an analytical study of the present routing of street cars and motor busses. They play an important, and frequently a controlling part in the movement of traffic. There are a number of examples in American cities where a rerouting of street cars resulted in an actual saving to the transportation companies and at the same time greatly improved conditions on the streets.

Survey of Regulations.—The best designed and most adequate street system may be rendered inefficient if traffic is regulated in an improper manner. There is a lack of reliable information in all cities as to the actual effects of various types of regulation. The valuable conclusions at which cities might have arrived from their experiments with different types of control have been almost entirely lost because no comparable data have been collected.

An example which illustrates the situation is to be found in the growing use of synchronized movement of traffic. Hundreds of thousands of dollars have been sent in the past few years for this type of control mechanism, and yet few cities have thought

it necessary to obtain facts regarding the results. Another example is seen in connection with the regulation which prohibits left-hand turns at street intersections. Officials have been satisfied in most cases to accept the superficial results which seem to indicate that the traffic flow has been improved. The secondary effect of additional car miles thrown on the streets has been neglected.

Types of regulation are so numerous, and local conditions are of such a variable character that it is impossible to suggest methods for the study of regulations which will have general utility. It does seem proper, however, to emphasize the necessity of making a careful study of traffic movement before and after the introduction of every new type of regulation, in order that some accurate conclusion can be drawn as to its effectiveness. The periodic study of traffic which has been previously discussed, and the following suggestion for a study of traffic safety will assist in the drawing of conclusions regarding the types of regulations which are desirable.

STUDY OF TRAFFIC HAZARDS

The most distressing aspect of the traffic problem, that of injuries and deaths, appears to be the one that has least concerned public officials. In many cities no reports of traffic accidents are kept by the police and the only indication of the numbers, types, or location of accidents is to be found in the superficial reports of the coroner's office. Without records of an accurate and comprehensive nature it is impossible to arrive at conclusions regarding the causes of accidents or means for their elimination.

The study of street hazards is not one that can be made in a day. Careful and comprehensive records must be kept for long periods of time in order to obtain facts for accurate generalizations. The first step, therefore, in approaching a study of this phase of the problem is the adoption of a report form which will give the desired data. It would be of great assistance to the advance of public safety work if the report blank could be made uniform throughout the country, for in this manner results of a comparable character could be obtained. The forms prepared by the National Safety Council have been adopted by a number of American cities and are undoubtedly the best and simplest available.[1]

[1] "The Trend of Public Accidents," pp. 22–23 and pp. 26–27, Chicago, 1922.

The police are the natural agents in the city for the collection of this information for it serves as a valuable basis for the prosecution of offenders against the traffic laws of the community, as well as making an understanding of the accident situation possible. The investigation of accidents should be required of the police, and should be made by them for every vehicular accident resulting in injuries requiring medical attention, and for all accidents involving a property damage beyond a nominal sum.

This function of the police department can be most effectively carried on in the larger cities by an accident investigation bureau. In New York, Philadelphia, Detroit, and Baltimore officers with special training have been assigned to this work and have obtained excellent results.

In addition to the requirement that the police collect information regarding accidents, the local traffic regulations should require all motorists who are involved in accidents to make an immediate report to the nearest police station or to the headquarters of the traffic police or accident investigation bureau. In this manner many accidents which would otherwise escape the notice of the police will be recorded.

Before adequate plans can be made for increased safety, knowledge must be had of the location of hazards which are most dangerous. All report forms should provide for such information. The data thus collected may be most graphically presented by the use of a pin map. The map is prepared by placing pins of different color, according to the type of accident on a city map at points where accidents have taken place. Such a map, easily prepared from the reports, reveals the location of danger points in the city which should demand the first attention of the traffic engineer.

The proposals for the traffic survey as set forth in this chapter are of necessity general. Special local conditions require special methods of study. The suggested survey is, however, more complete than has been carried on by any American city, and it is believed that it represents the minimum of information necessary for an intelligent understanding of the traffic problem.

CHAPTER III

CAUSES OF CONGESTION: THE STREET PLAN

The term congestion as generally applied to street traffic is used to designate almost every type of undesirable condition. If the term is to be retained as a useful descriptive word its meaning should be defined with care.

Congestion should not be confused with density, or that condition which exists when there is a large number of vehicles or pedestrians in a limited street area. An individual standing on a crowded sidewalk viewing a display window is not aware of congestion until such time as he attempts to make his way through the crowd and finds his path obstructed. So, too, a driver may park his automobile in a small area where scores of other cars are parked, but the mere numbers of cars do not create congestion unless they block his free movement. Density of the traffic stream is usually a concomitant of congestion, sometimes being the cause, sometimes the effect.

Similarly a distinction should be made between congestion and what may be called a high discharge factor, that is, the ability of a street to pass a large number of units of traffic in a relatively short length of time. Indeed, adequate rapidity of movement, no matter what the numbers composing the stream, results in a condition quite the opposite of that which may be described as congested.

Congestion in street traffic may be defined as a condition resulting from a retardation of movement below that normally necessary for contemporary street users. Congestion is due to three general causes: (*a*) the inability of the streets to hold a sufficient number of vehicles and to pass them at an adequate speed; (*b*) the inclusion in the traffic stream of elements which hamper its freedom of flow; (*c*) the improper or inadequate direction and control of traffic. The first factor will be discussed in this chapter and the remaining two in the chapter following.

The Failure of the Streets to Keep Pace with Traffic Demands.—The fundamental cause of traffic congestion may be summarized

in the statement that cities have outgrown their streets. The average street in an American city has the same capacity today that it had a hundred years ago while the city itself may have doubled its size many times over.[1] Boston, for example, had a population of approximately 40,000 in 1823, while the most recent census indicates a present population of nearly 750,000, yet Boston traffic must find its way through the narrow streets which served the citizens a century ago. Not only have the streets failed to keep pace with the growth in population, but such an expansion would have been impossible, for had they been so widened they would occupy the greater part of the city area.

Business and the Concentration of Population.—Increase in population alone would not have placed the present-day pressure upon the street system had it not been for the fact that business districts have remained relatively restricted. Instead of moving outward they have moved upward in order to accommodate increasing demand for space. Thus it is that the daytime population of the business or so-called congested area of the city has increased with even greater rapidity than the population of the city as a whole. As an example it is estimated that the daytime population of the Boston business district exceeds 500,000, or a number equivalent to two-thirds of the population of the city proper. The dense concentration of population thus places a far greater burden on the central street system of the city and on the major arteries leading to the business district than would be indicated by the increase in population alone.

In Chicago, for example, the average of a 2-day's count (July 31 and Aug. 1, 1923) taken at the Michigan Avenue bridge showed the passage of 54,014 motor cars during a 17-hour period.[2]

[1] BIBBINS, J. ROWLAND, *Railroads—the Arteries of Commerce, Proc., Am. Soc. Civil Engineers,* pp. 1423–1424, Sept., 1923. "The fact is that the traffic of the Nation has grown in geometric ratio to the population, while facilities . . . particularly streets and roadways in the larger centers, have increased, if at all, only in arithmetic ratio . . . Motors, however, are increasing far beyond the fourth power of the population, and city motors probably as fast if not faster. Nevertheless, in the majority of cities, practically nothing is being done to survey and develop the capacity of the street system for handling this enormous flood of passenger and freight traffic—for transfer and city destination. Instead, building heights are being forced upwards, which only intensifies the problem."

[2] The author is indebted to MAJOR R. F. KELKER, JR., engineer in charge of the survey for these figures.

The latest statistics of automobile registration in the same city indicate that there are but 210,500 motors in operation. In other words a number of motor cars equal to one-fourth of the entire number in the city passed by one point on a single day. When it is realized that Michigan Avenue is but one of many streets giving access to the Loop District, and that much of the traffic in that district is interterminal, one can gain an idea of the way in which business draws the population to the center of the city.

Pedestrian counts likewise throw light on the situation. A count made in February, 1923, at State and Madison Streets in Chicago showed that in 1 hour 46,600 pedestrians passed through the intersection.[1]

Social Activities and the Concentration of Population.—It is not business alone, however, that concentrates population and results in throwing greater burdens on the streets than they were designed to bear. Social activities also draw people to a common center. Every city has its theater district and its theater rush. The *roaring forties* in New York perhaps offer the best illustration. Within a distance of a few blocks from Forty-second Street and Broadway there are seventy-eight theaters having a total seating capacity of 95,294. Within a radius of 1,000 feet from the same intersection there are forty-three theaters having a seating capacity of 55,911.[2] When it is realized that practically all of the performances begin at the same hour and that there is a certain amount of uniformity in the completion of the performances an idea of the concentrated street burden can be obtained.

Terminals and Focal Congestion.—Another type of demand which has rendered the streets inadequate is the increase in the volume of materials which must be collected and taken to the terminals, or distributed from the terminals to their destination. Passenger and freight traffic has become so great between terminals in some cities as to interfere seriously with business and to threaten a decline in property values which otherwise would be increasing. Some years ago a survey of less-than-carload freight movement in Chicago showed that 60 per cent of the total was

[1] "A Unified Transportation for Chicago," p. 41, by the same authority, Chicago, 1923.

[2] LEWIS, NELSON P., director of "The Plan of New York and Its Environs," quoted in *National Municipal Review*, vol. 12, p. 271, May, 1923.

transferred to other terminals, more than half of it by trucks using the downtown business streets.[1]

Motorization of Urban Population.—The growth in population and the increase in concentration afford a sufficient explanation for the inadequacy of city streets, but there is an additional factor to consider. Thousands in every city, who a generation ago would have lived in close proximity to their labor, or who would have used rail transportation facilities, now ride through the streets to their daily work in their individual motors.

The increase in the wage and salary scale during the last two decades has been accompanied by a decrease in the cost of the automobile. The advent of the low-priced motor car has rendered this means of transportation available to almost every class of society. Few who desire to ride need walk, and increasingly few do.

Street Construction and Congestion.—Speed of movement as well as area influences the traffic capacity of the streets. If speed is increased, the street capacity is increased, though the area remain the same. The factors in the street system which affect congestion through their influence upon speed are construction, continuity, uniformity, grade, and direction.

The *construction* of the street has a definite bearing upon its traffic capacity. A street with a poor surface is of necessity a street of relatively slow movement. In practically any city in the country an example can be found of a heavily traveled street which carries large numbers of vehicles at a reasonable rate of speed, but which becomes congested in those parts where the surface is in poor condition.

The practice in many parts of the country of building streets with an unnecessarily high crown unduly hinders flow. Motorists keep as close as possible to the center of the roadway where they may drive on a relatively even keel. This practice limits the usable area of the roadway, for an overtaking vehicle often cannot pass to the left because of on-coming traffic and dares not pass to the right because of the *law of the road.* Traffic is thus forced to move in a single line, the speed of which is regulated by the speed of the slowest unit. Heavy crowns likewise reduce the speed of vehicles in snowy or rainy weather for they increase the tendency to skid.

[1] BIBBINS, J. ROWLAND, *Railroads—the Arteries of Commerce, Proceedings, Am. Soc. of Civil Engineers* p. 1428, 1923.

The open drain is another constructional feature which reduces speed. In many cities it is the practice to carry the gutters across intersecting streets by means of depressions in the surface. These are often of such depth that the speed of vehicles must be greatly reduced in order to cross with comfort and safety. Streets which are well constructed in all other respects to carry a heavy traffic are deserted by motorists because of this feature alone.

The most disastrous result of improper street construction from the standpoint of congestion is that such streets do not carry their fair share of the burden. They repel rather than attract traffic. As a consequence the flow is diverted to other arteries which are in better condition. These soon become congested, whereas if all carried their full quota traffic would move with greater expediency. An example of this is to be found in St. Louis where a well-located street, formerly heavily traveled by horse-drawn trucks, was deserted with the advent of motor traffic because of its cobblestone pavement. Some years ago the street was repaved with faced granite blocks and it immediately regained its former popularity.

Irregularity in the Street Plan and Congestion.—A lack of continuity is another fault in the street plan which results in congestion by reducing facility of movement. American cities are filled with examples of streets which have adequate area and would be admirably adapted to carry a heavy traffic stream were it not for the fact that they either *dead-end* or *offset* after a short distance. Washington Street in Boston for more than a mile of its length through the business district is not crossed directly by any intersecting street. The older cities whose streets developed from cow lanes are not the only ones which suffer in this respect. Los Angeles did not avail itself of the opportunity which it had 20 years ago to plan for its future traffic needs.[1] As the city rapidly spread out real estate sub-

[1] Automobile Club of Southern California, *The Los Angeles Traffic Problem*, p. 9, Los Angeles, 1922. "One of the features that is strikingly brought out by a study of the aerial map of the city of Los Angeles . . . is that the subdivisions of the various tracts of land which have gone to make up the building of the city have been the results of individuals' ideas and plans, without coordination with adjoining subdivisions. Vermont and Western Avenues are practically the only avenues in the western part of the city which run continuously through that section. This results in abnormal congestion on these two streets."

dividers were permitted to arrange their own street plans without regard for the adjacent streets. As a result one finds examples of 80- and 100-foot streets which are practically isolated units, beginning nowhere and leading nowhere.[1]

Streets without continuity are avoided by through traffic. Dead-end streets are of course useless, and streets with frequent offsets make driving difficult. The entering of a vehicle upon the flow of a cross street at the offset, or even the making of the two right-angle turns greatly reduces the otherwise possible speed.

Bottle Necks and Congestion.—A lack of uniform width results in a great waste of valuable street area. Constrictions or *bottle necks* as they are frequently called not only serve to cause congestion by limiting flow at their location, but so far as through traffic is concerned they limit the capacity of the entire length of the street. As the capacity of a water main is to be determined by its smallest section so the flow capacity of a street is limited to a large extent by its narrowest portion.

One type of bottle neck is that which exists through the narrowing of a street for a short distance. An excellent example of this type is to be found in the approach to the Union Station viaduct in Kansas City, Missouri. The viaduct was built at considerable expense and in location and design is properly prepared to carry heavy traffic. All traffic over it, however, must pass through a constriction only 18 feet in width. Another example of the lack of uniform width, of which there are thousands in the country, is to be found on Broadway and Market streets in Paterson, New Jersey. Broadway has a width of 80 feet east of Eighteenth Street but narrows to 66 feet between Eighteenth and Main Streets. West of Main Street it has a width of 60 feet but finally ends with a 38-foot width at Prospect Street. Market street likewise varies, having at different points widths of 50, 60, and 90 feet.[2]

Street Gradients and Congestion.—Heavy grades are another cause for congestion. They place a limitation upon the street system in two ways. The average motorist wherever possible avoids a steep hill, and streets which but for their gradients

[1] See regulation adopted by the City Planning Board of St. Louis. *Annual Report for* 1921–1922, appendix, rule 8.

[2] SWAN, HERBERT S., "The Thoroughfares and Traffic of Paterson," Paterson, N. J., 1922.

might be heavily traveled are practically deserted and their flow diverted to other channels. In Boston the Beacon Street hill though not a heavy grade is often not used to its full capacity, though it affords a direct route which could by-pass much traffic around a heavily congested district. The hills in the business district of Kansas City offer considerable obstruction to the free movement of traffic. Both San Francisco and Los Angeles have serious hill problems. In the former city, California and Sacramento streets are well located, and except for their heavy gradients could carry much traffic directly from the business to the residential areas. Notwithstanding the efforts of the San Francisco police to convince the citizens that the climbing ability of the motor car has eliminated the hills of the city, relatively few motorists use these streets.

The major business district of Los Angeles is hemmed in on the west and north by hills so steep in places that the extension of streets up their sides is impossible. Where streets have been placed their grades are such that they are not used to their fullest capacity because of the reduced speed in climbing or descending and because of the danger in wet weather. This condition has been alleviated in part by the building of tunnels.

Improper Direction and Congestion.—Improper direction is the final way in which streets cause congestion by making impossible the most rapid flow. The rigid adherence in most cities to the rectangular street plan makes it necessary for vehicles to go along two sides of a square in order to reach their destination.

From the standpoint of proper street direction Washington, D. C., presents an ideal plan. Here the rectangular plan has been modified by the introduction of diagonal streets so that it is possible for traffic to radiate from the center of the city in all directions following routes which lead directly to various parts of the community. Detroit likewise profits by such diagonal arteries as Michigan, Gratiot, Grand River, and those streets which radiate spoke-wise from Grand Circus Park.

CHAPTER IV

CAUSES OF CONGESTION: THE CHARACTER OF TRAFFIC AND ITS REGULATION

Even though the streets have ample capacity to meet the normal demand placed upon them, general or local congestion may result from the nature of the traffic passing over them or from improper or insufficient regulation.

Peak Demands.—The demand which traffic makes upon the street system is not constant. The volume fluctuates from minute to minute, from hour to hour, from day to day, and from season to season. The minor fluctuations may be compared to the waves of the ocean. Observation on any highway or street will show the tendency of vehicles to move in waves instead of distributing themselves at equal distances over the length of the roadway. This tendency increases the density of traffic at different points, and tends to cause retardation in the movement of the entire train when the leading vehicle slackens its speed. Moreover, the unnecessary lessening of headway between vehicles is a frequent cause of accidents. This train-like movement of vehicles makes difficult the interweaving of traffic at intersections, and makes necessary longer waits for drivers wishing to cross the main stream. This natural tendency to move in groups is emphasized by the generally prevailing *block* control method.

There is also discernible in traffic an hourly fluctuation which may be compared with the tidal movement of the ocean. Every city experiences a peak load caused by the morning in-rush and the evening out-rush of traffic. If this demand could be spread over longer periods the congestion resulting from the maximum demand would be lessened. In Washington, D. C., during the war, there was some attempt to stagger the hours for opening and closing offices, thus reducing the demand made upon the streets and transportation systems at any one time. It is not impossible that, with the increase of congestion, cities may have to adopt some such scheme in order to distribute the peak traffic demand.

All cities likewise have heavy traffic days. In some cities this day is Saturday, occasioned by the habits of shoppers, and the Saturday afternoon matinees. In Los Angeles the Saturday peak has been distributed to some extent through the fact that the merchants have advertised Monday as a bargain day. When there is a proper understanding of where the peak load falls, city officials and merchants may find it profitable to distribute the burden by some such method.

Finally there is a seasonal fluctuation in traffic demand which may be compared with the equinoctial movement of the ocean.

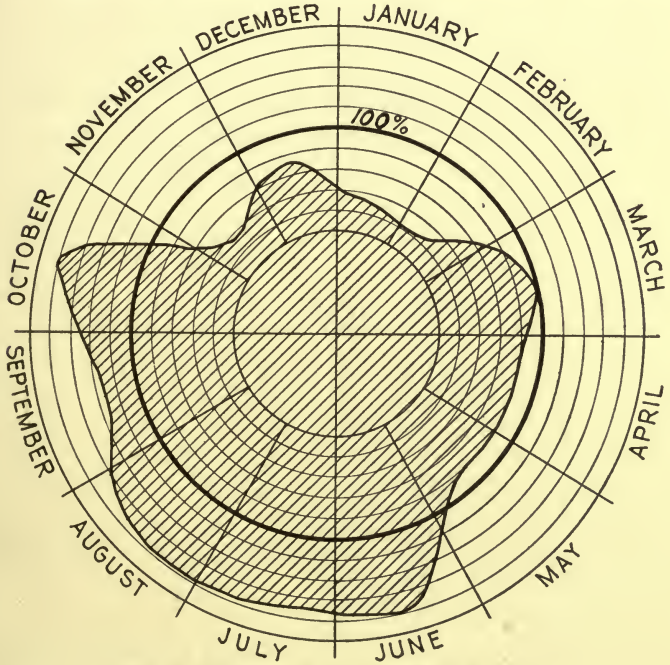

FIG. 3.—Seasonal fluctuation in traffic flow.

The amount of this fluctuation from season to season depends largely upon the location of the city and the type of business carried on. Los Angeles and San Francisco experience very slight seasonal fluctuations, while traffic volume in such cities as Denver, Chicago, and Boston varies widely in different parts of the year. In the winter season the condition of the streets tends to keep many cars off the street, while in the summer time the local burden has added to it the motors of tourists. Ernest

P. Goodrich, in a paper read before the City Planning Conference, arrives at an interesting conclusion: "The traffic during the maximum hour of the day varies from 115 to 140 per cent of the average hour. Traffic during the maximum week is approximately double the average of the year."[1]

Community Habit.—Another type of community habit which results in congestion is that where large numbers of local motorists use certain streets and disregard others which would carry them by an equally direct route to their destinations. Instead of

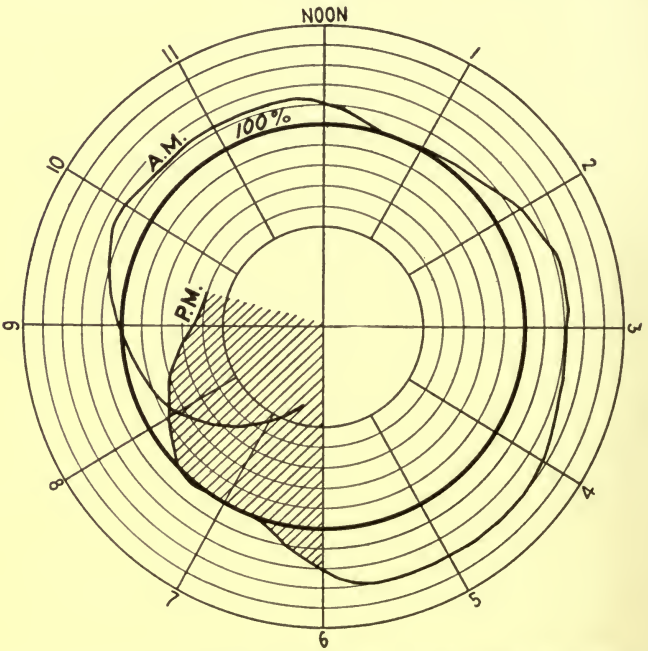

Fig. 4.—Hourly fluctuation in traffic flow. These charts are taken from an Article by A. N. Johnson, *Proceedings of a Conference of Highway Traffic Regulation*, pp. 14–15, Washington, 1921.

experimenting in an attempt to find less congested thoroughfares it appears simpler and more comfortable to follow the leader. This concentration is too frequently encouraged by business interests that confuse buying power with density of traffic. A number of cities have attempted to break down the habit of concentration by erecting signs which inform motorists of

[1] *Proceedings*, National Conference on City Planning, pp. 101–102, 1922.

alternative routes of travel, and especially of the location of thoroughfares which make it possible for through traffic to avoid the congested district.

The Mingling of Fast and Slow Vehicles.—The traffic stream frequently carries within itself elements which retard its own progress. In dense traffic the slow vehicle tends to retard the speed of all others inasmuch as it is difficult for them to pass. Cities have attempted to overcome this condition by a segregation of the two types requiring that slow-moving vehicles shall keep to the right of the roadway. Unfortunately the rule is rarely enforced. Another type of segregation is that found in the prohibition against trucking on boulevard streets. The rule is usually the result of a desire to protect the surface and increase the beauty of the thoroughfare, but it has the effect as well of increasing its hourly capacity, and indicates a method which can be used more widely with profit.

Slow, horse-drawn or heavy, commercial trucks have a particularly serious effect upon the movement of lighter and faster vehicles, for in addition to their slower speed they are often of such width that they render overtaking difficult and hazardous. Much of the vehicular troubles on Washington and Tremont Streets in Boston is due to the fact that commercial vehicles of all sorts, from small trucks to large vans, now use these thoroughfares, when they ought to be reserved for a different class of traffic.[1]

The principle of segregation and the situation which makes it necessary is well expressed by the Engineers of the *Plan of St. Paul*—"On a street offering room for one line of vehicles a heavy horse truck will place all light, speedy vehicles following in its own class, and there will be intense congestion from the point of view of the motor vehicle."[2]

The Mingling of Rail and Free-wheel Vehicles.—Rail and free-wheel vehicles find it difficult to move in the same traffic stream without offering mutual obstruction. The feud between the street car and the automobile is of long standing and in some cities of considerable bitterness. Both vehicles perform a valuable service but neither can do its work to the best advantage when it is forced to move in the same roadway with the other.

[1] *Report of the City Planning Board of Boston*, City Record, p. 914, Nov. 5, 1922.

[2] The City Planning Board, *The Plan of St. Paul*, p. 32, St. Paul, 1922.

The friction between the street car and the automobile does not result chiefly from a difference in speed, for the modern street car compares favorably with the automobile in its accelerating, braking, and running speed. The difficulty lies in the fact that the street car does not follow a flexible route; it cannot depart from its predetermined course of travel to take advantage of favorable openings. Further obstruction is caused by the fact that the street car has business to perform at every intersection in the congested portion of the city. This business cannot be timed to meet the requirements of traffic flow, but is determined entirely by the number of persons entering and leaving the car. Thus when the signal is given by the officer for traffic to move, the street car may be unable to start, and its inability obstructs the movement of motor vehicles which have found a place in line behind it. Even though the drivers are able to pass beside the street car they can do so only through a limited street area, and with some hazard to passengers entering and leaving the street car.

It is difficult to estimate the amount of obstruction offered by the street car to free traffic movement; it varies, of course, according to the width of the roadway. When the street is very narrow the rail vehicle may make movement by other vehicles impossible during the time it is standing. This is one of the elements in the traffic problem in Philadelphia where practically all of the narrow downtown streets have car lines. The experience of Chicago indicates something of the amount of obstruction offered. During a street car strike in 1922 one-way traffic was adopted for the business district and it was found that intersections carried 3,000 vehicles per hour, indicating on the basis of previous counts that the absence of street cars added 50 per cent to the street capacity.[1]

This, however, is but one side of the story; vehicles in turn hamper the free movement of street cars. The *dragging* of street cars by slow-moving vehicles driving in the tracks has become so serious that in some cities ordinances have been passed forbidding the practice. In others, vehicles are permitted to line up at the intersection, in the street car tracks, making it impossible for the car to reach its loading zone until such time as the vehicles have moved out. Improper parking and loading and unloading of vehicles offers further hindrance to free move-

[1] KELKER, R. F., JR., *Electrical Railway Journal*, p. 483, Sept. 13, 1922.

ment of rail traffic. Street cars are unable to change their course to avoid obstructions which protrude into their right of way and hence must stand until the obstruction has been removed.

The Pedestrian and Congestion.—Another element in the traffic stream which results in retarding of movement is the pedestrian. There was a time when traffic on city streets was of such a character that it was possible for the walker to use the roadway as well as the sidewalks without causing undue obstruction or creating serious hazards. This time has long passed, yet the *jay-walker* survives in every city.

The amount of interference to traffic resulting from jay-walking is frequently underestimated, though the hazard of the practice is to be seen reflected in the mortality statistics of any community. Observations in Cleveland showed that in one block on Euclid Avenue, 1,450 pedestrians crossed the street in one hour, at places other than the designated crosswalks. A similar count in Chicago showed 1,260 jay-walkers an hour per block. The business districts of other cities revealed similar conditions. It is true that it is the moral and legal duty of the driver of a motor car to be constantly on the alert to avoid collision with other vehicles and with pedestrians, but to expect him to maintain a rate of speed necessary to avoid undue congestion, and at the same time to weave through masses of pedestrians, is an impossible demand. Pedestrians not only interfere with traffic flow by crossing the streets at mid-block, but they are usually unwilling to observe signals at intersections and wait their turn in the traffic. This condition necessitates a much slower speed on the part of drivers who have been given the right of way by the intersection officer, and often results in serious injuries. Even where the pedestrians do not attempt to cross against signals, they not infrequently crowd into the street while waiting for their release and thus reduce the area available for vehicular movement. The ultimate solution for this type of interference is the same as that indicated for slow-moving vehicles and street cars; that is, complete segregation of the warring elements so that it will be physically impossible for them to come into conflict.

The Cruising Taxi and Congestion.—Another element in the traffic stream which adds considerably to congestion, especially in the larger cities, is the cruising taxicab. These cabs, either because they have no fixed stands, or because more business is desired, cruise through the streets looking for fares. Since

prospects are most likely to be found in the busier parts of the city they seek those districts, adding to the already too great burden carried by the streets.

A study in New York City completed in April, 1923, indicated that there were 24,000 licensed taxicab drivers and about 15,000 licensed taxicabs, while the hack stands available provided accommodations for only 1,500.[1] Taxicab licenses were at that time increasing at the rate of fifty per day. The report pointed out that, "Each taxicab unprovided with a stand as it is at present and for which a stand cannot be found, of necessity and in order to get business is constantly cruising on the public streets." The conclusion of the committee was that there were 3,000 more taxicabs in New York than were needed, and that the number should be reduced to 12,000.

The amount of the burden which these cabs throw upon the streets is indicated by a study made by Morris A. Hall (Dec. 18 and 19, 1923). Of 299 northbound cabs, 174 or 58.2 per cent were empty, and of a total of 360 southbound cabs, 210 or 58.3 per cent were empty. Of the total of all vehicles counted taxicabs were found to be 36.2 per cent, while empty cabs represented 21.1 per cent.[2]

Regulation and Congestion.—In addition to the congestion resulting from the inadequacy of the streets and from the nature of the traffic flowing over them, further retardation of movement may result from a lack of regulation or from the use of improper control.

Too much of the present-day regulation is based on the assumption that vehicles must be stopped in order that they may be controlled. From the standpoint of keeping the streets free from congestion the ideal type of regulation is one which affords as much continuity of movement as is consistent with a fair opportunity for all pedestrians and riders to use the streets. While some stopping of traffic is necessary to obtain this end, emphasis should be placed on moving traffic at every opportunity and stopping it as rarely as possible.

Congestion Resulting from Unnecessary Obstructions.—Much retardation of traffic results from improper encroachment upon the street area.

[1] *Report of the Mayor's Committee on Survey of Licensing and Traffic*, p. 3, New York, 1923.

[2] *New York Times*, sec. 20, p. 9, Dec. 30, 1923.

The fundamental and most important use of any street is to carry traffic—foot, hoof, or wheel; through or local; from 10-ton trucks to baby carriages; horse-drawn or motor-driven, and at rates of speed from 2 miles an hour to the legal limit. When a street is used for any other purpose it is because it offers the most favorable and cheapest opportunity for this; frequently because the citizens permit individuals or corporations to save themselves expense at that of the people at large. But the traffic in the street is what characterizes it.[1]

There was a time before the growth of heavy traffic when the use of the streets for other purposes than traffic offered no serious impediment to movement, but in every city at the present day the full area of the streets is needed for vehicles and pedestrians. Regulations should be designed to free the streets from obstructions which limit their capacity.

The use of the roadways and sidewalks for the loading and unloading of trucks is one of the most prevalent types of obstruction. So long have private individuals exercised this privilege that they have come to think it a vested right, failing to realize that the obstruction which they create is a hinderance to their own interests as well as to the interests of their neighbors. This type of obstruction becomes especially obnoxious when large trucks attempt to unload their freight on busy streets at the time of maximum traffic demand.

Another type of obstruction results from a failure to regulate the use of the streets for advertising purposes. In some cities private individuals fit out large vans with posters and send them through the public streets. These advertising vehicles seek the more heavily traveled streets and move at a slow rate of speed that their message may reach the largest possible number of persons.

In some cities there is a failure to regulate the use of the streets for the storage and display of merchandise, and much of the valuable sidewalk space is often taken for this purpose.

Unregulated street openings by public departments or by private corporations often result in traffic disturbance. On the busiest city streets one can find examples of openings made for the purpose of repairs in water or sewer mains, in gas pipes, in electric conduits or other subsurface installations. Some of this work is urgent, but so is the traffic demand. With suitable

[1] "Practical Street Construction," *Municipal Journal*, p. 10, New York, 1916.

regulation many of these obstructions could be confined to periods in the day or week when they would offer a minimum obstruction. In all cases of openings on major traffic streets provision should be made for the greatest possible speed in the work.

A similar type of obstruction is to be found where private individuals are permitted to keep building materials in the streets. On secondary streets such a practice may cause but little inconvenience, but where the obstruction is on a primary traffic thoroughfare the public must pay a heavy price for the contractor's privilege. The piling of building material in the roadway not only reduces the usable area but creates considerable hazards in night driving. As has been demonstrated in many cities contractors can keep with a little care, and at slight additional expense, the greater part of their materials inside the property line.

Broken-down vehicles are another form of obstruction which is too often unregulated. It is a tribute to the manufacturers of motor vehicles that it is becoming more and more rare to see an automobile or truck disabled in the public streets. Where there is much heavy trucking, however, the failure of a truck to function often results in its being left in the traffic stream with considerable inconvenience to other vehicles. A number of cities have regulations requiring owners to remove disabled machines immediately, and several cities have public tow cars with which the work can be done in case private owners are negligent.

The Parked Vehicle and Obstruction.—The problem of the standing vehicle is far too complicated to discuss in its entirety at this point, but it should be noted in passing that parking is one of the most serious causes of congestion. Few cities have yet faced the problem squarely, but all will be forced to within the near future. The simple parking of motors parallel with the curbing reduces the usable area of the roadway by one lane; angle parking encroaches upon another lane, and in some cities double and triple parking threaten to take the entire street area.

Right- and Left-hand Turns and Congestion.—The practice of requiring all left turning traffic to pass around an intersection marker or officer stationed at the center of the crossing is another type of regulation which results in slow movement and in unnecessary conflict. Such a rule for the intersections of wide streets

in the outlying districts has its advantages, but on the downtown streets and especially at policed intersections, the regulation results in increased conflicts and in a lessening of speed through a shortening of the turning radius.

The regulation which has recently come into vogue whereby left- and right-hand turns are prohibited at certain intersections is one of very doubtful value, for though the movement of vehicles is simplified at the point where the rule is in force the ultimate result is that hundreds of unnecessary car miles are daily required.

The Absence of Regulation.—A final manner in which regulation causes traffic difficulties is to be found in the failure of many cities to provide suitable rules for modern conditions. One city for example labored until a few months ago under a vehicle code which had not been revised since 1911. In other cities the local rules fail to provide for important types of movement and drivers act according to their own whims, with resulting chaos. And some cities, though possessing satisfactory codes, make no provision for their publication, so that individuals may be informed of their rights and duties.

CHAPTER V

REPLANNING THE STREET SYSTEM FOR TRAFFIC RELIEF

The most fundamental cause of traffic congestion, as has been pointed out, lies in the fact that cities have outgrown their streets. Any attempt, therefore, to solve the existing traffic problem must give special attention to ways and means for reestablishing a more equal balance between street capacity and the demand for street use. Much of the present trouble in the street system finds its origin in the fact that the early city designers were unable to foresee the growth of the communities which they were planning or to forecast the change in volume and character of traffic demands. Had William Penn, for example, been able to anticipate when he laid out the street system of Philadelphia in 1682, that the modern city would cover an area of 130 square miles instead of the 2 square miles which he planned; that Market and Broad streets would be lined with skyscrapers instead of two- and three-story buildings, and that within 250 years man and horse transportation would have given way to the motor, his methods would have been different. Similarly a view of the future would have influenced the plans of the commission which laid out the street system of upper Manhattan Island in the year 1807. Thanks to the foresight and liberal imagination of Major L'Enfant, its designer, Washington, alone, of all the greater cities of the nation possesses a street system most nearly adequate for present demands.[1]

[1] Munro, William Bennett, "Municipal Government and Administration," vol. 2, pp. 73–75, New York, 1923.

The proportionate area devoted to roadways in the congested areas of some of the more important American cities is indicated by the following table:

	Per Cent
Washington, D. C.	44.0
San Diego, Cal.	41.0
Cleveland	39.5
Seattle	37.5
St. Louis	37.0

The original designers, however, are not those chiefly at fault. Cities have blindly copied the street schemes of other communities without thought of their suitability for local conditions, or even worse, have permitted the interests of private land-owners to dictate the methods to be followed.

The Need for Careful Planning.—With the increase in motor traffic there has been a growing realization that no satisfactory solution for the problem of street inadequacy can be obtained until the city has a well-developed and comprehensive plan. With a knowledge of the lines of urban expansion and the characteristics of mechanical transportation it is possible to undertake a rectification of the errors of the past. The need for the planning of a comprehensive major traffic street system in a scientific manner is well expressed by Harland Bartholomew:

> The building of a city is such a highly artificial process subject to such revolutionary changes in methods of transportation, that it is questionable how far the needs of another generation can be anticipated. Yet it has become quite evident that there are certain well-defined classes of streets which the individual landowner cannot so readily recognize as can one who has the whole city problem in mind. Only recently has the necessity and value of public control of street planning been recognized. Public control of street plan cannot entirely anticipate every need, but such control, when wisely exercised, can scarcely fail to improve immeasurably many unpleasant and unsatisfactory conditions.[1]

A Measure of Street Capacity.—The width of streets has too frequently been determined by some rule-of-thumb or plan of standardization which fails to take into account the character of the traffic which they are to bear. As a result there is found in every city the wasteful situation where the major streets are too

	Per Cent
San Francisco	34.5
Pittsburgh	34.0
Portland, Ore	34.5
Minneapolis	30.5
Detroit	29.5
Chicago	29.0
Denver	27.5
Salt Lake City	25.5
Toledo	24.0
Los Angeles	21.5

[1] "A Major Street Plan for St. Louis," p. 4, St. Louis, 1917.

narrow and the minor streets are too wide. There is no ideal width for different classes of streets: the area must be determined according to the special demands which are to be made in the future. Once this demand has been estimated the thoroughfare should be adjusted as far as possible to meet it. But if the wasteful methods of the past are to be avoided this adjustment must not be done by guesswork. When antiquated water pipes are replaced, mains of an estimated capacity are installed. Engineers are able to determine this capacity with a high degree of accuracy. Is there not some method whereby the capacity of streets can be similarly determined? It is believed that there is. As in the case of water mains the capacity of streets is determined by volume and speed of flow. Attention is first turned to the former factor.

Street volume is determined not by the gross width of the roadway but by the number of vehicle lines for which it provides. Thus a street on which two lines of vehicles can move side by side has twice the capacity of a street on which but one line can move at a time, though the latter may be but a few feet narrower. In designing a street to meet an estimated demand the first question to be considered, therefore, is how much space is required for a single line of traffic. The total width of the roadway can then be determined by taking some multiple of this figure.

There are two elements in modern traffic which necessitate a liberal estimate of traffic lane widths. One is the fact that the speed of vehicles is constantly increasing. Police not only permit but encourage a rate of speed which even 10 years ago would have seemed unthinkable. With the increase in speed there comes a necessity not only for greater headway between vehicles but for greater leeway as well. A driver who is traveling at even a fair rate of speed dares not approach other vehicles as closely as he would if he were traveling more slowly. At intersections one may observe two or three lines of vehicles standing in close proximity to one another waiting for release by the traffic officer, but it will be noted that as soon as the vehicles start moving and attain some speed the distance between them will be increased and the number of lines moving abreast will be decreased. The failure to consider this characteristic of high-speed traffic is one of the reasons why streets which were designed to carry three or four lines of traffic succeed in carrying but two or three.

The other element in present-day traffic which makes wider lanes necessary is the tendency toward the use of heavier and wider vehicles. It is true that manufacturers have attempted to establish maximum standards of vehicle widths, but the tendency in the development of all transportation is toward units of greater and greater capacity. From the standpoint of traffic movement it is desirable that this tendency, with certain reasonable restrictions, should be allowed to develop. Already there may be seen on the streets numerous heavy trucks and busses which exceed the accepted 7-foot width This increase in width combined with the increase in speed requires a reconsideration of the roadway unit or traffic lane width.

Measurement of the customary practice of drivers on high-speed streets is difficult to make, but observation of actual traffic conditions indicates that traffic moving at 15 miles per hour or more, requires a minimum leeway of 3 feet between the vehicles. With increased speed in the future and with greater vehicle widths more may be required. However, with present conditions in mind the acceptance of 10 feet as a general standard for traffic lane widths does not seem unreasonable.[1] This allows each line of traffic a physical width of 7 feet and 1½ feet on each side for maneuvering.

Attention is next directed to the speed of flow, the second factor which determines street capacity. The discharge capacity of the street will be the total of the discharge capacities of traffic lanes accommodated by its roadway. The number of vehicles per hour which can be carried by a single traffic lane on any particular street will vary according to the average speed which can be maintained, as determined by the character of the traffic, the surface of the roadway, and the amount of cross traffic interference. Methods for calculating this speed have been pointed out in the chapter on the traffic survey.

[1] It is interesting to note that this calculation is substantiated by the computations of the engineers in charge of the construction of the Hudson River vehicular tunnel. *Report of the New Jersey Interstate Bridge and Tunnel Commission*, p. 44, Trenton, 1920, and also that the Motor Vehicle Conference Committee in a pamphlet entitled *Governmental Restrictions on Motor Vehicle Sizes, Weight, and Speed*, p. 4, New York, 1924, proposes that width including load should be set at 96 inches, and indicates that "in order to admit of the safe passage . . . a highway at least 20 feet in width is desirable."

One of the most interesting studies of traffic speed in its relation to roadway capacity is that made by Herbert S. Swan, City Planner, in which he determines the discharge capacity of a single traffic lane by a calculation of the necessary headway between cars on the basis of the number of feet covered in stopping at various speeds.[1]

Mr. Swan says in commenting on his conclusions:

> An increase in speed by no means increases the capacity of a roadway. Paradoxical as it may seem, the direct opposite is true, for though a fast car may travel between two points more rapidly than a slow one, it does so when the roadway is used to capacity only by driving other cars off the highway.
>
> The speed that will pass the maximum number of cars with equal safety is not one of 50 miles an hour, nor one of 40 miles an hour, nor even one of 30 or 20 miles an hour. It is the prosaic gait of 10 miles an hour. A uniform speed of 10 miles an hour will pass a third more vehicles than one of 25 miles; and half again as many as one of 30 miles. A speed of 60 miles will pass scarcely more than a third as many vehicles as one of 10 miles. Even a speed of 5 miles an hour will pass more vehicles than one of 30 and twice as many as one of 60 . . . The common impression is that the faster the speed the greater is the number of vehicles which can pass a point in a given length of time. This is true for quite low speeds. Each increase in speed up to a certain point does increase the capacity of a roadway, but after a certain speed has been attained, each unit of increased speed requires such an increased spacing of machines that the roadway capacity is diminished. If accidents are to be avoided, machines should certainly not follow each other any closer than the distance it takes to stop.

A somewhat similar conclusion has been set forth by Dean A. N. Johnson, on the basis of observations which led him to the belief that if the clearance between vehicles varies as the square of the velocity, "a larger number of vehicles will pass a given point at a speed of 15 miles per hour than at 30 miles per hour."[2]

The fact, however, that a larger number of vehicles can be moved at a lower speed than at a higher speed does not logically lead to the conclusion that congestion will be decreased by forcing all traffic to move at the lesser rate. In computing the capacity of a street the rate of speed which is deemed reasonably neces-

[1] "Automobile Control, City Planning, and Traffic Regulation," *Engineering News-Record*, pp. 351–353, Feb., 1923.

[2] *Proceedings of a Conference on Highway Traffic Regulation*, Highway and Highway Transport Education Committee, p. 18, Washington, 1921.

sary, and not that which results in the greatest discharge capacity must be used.

Moreover, it should be pointed out that the use of the four-wheel brake and similar contrivances on motor cars, will serve to increase the discharge capacity per lane at the higher speeds by decreasing the time and distance required for stopping, and thus reducing the headway which must be maintained.[1]

Indeed, none of the foregoing conclusions can be accepted as fixed.[2] Their consideration, however, emphasizes the necessity to plan thoroughfares to meet the requirements of automotive vehicles. The manufacturers of automobiles have gone far in adapting machines to the conditions found on existing thoroughfares, but there are limits beyond which they cannot go. Satisfactory street plans must be modified by the requirements of the special types of vehicles which are to use them.

General Ways in Which Street Capacity Can Be Increased.—There are two general ways in which a street can be given a greater traffic capacity. In the first place its capacity can be increased by widening the roadway to such an extent that additional lines of traffic can be accommodated. In the second place a street's capacity can be increased by changes in its construction —as through the elimination of grade crossings—so that a higher average speed can be maintained. The first method will be considered in the present chapter, and the second in the chapter following.

What Streets Should Be Replanned.—Street widening is such an expensive undertaking that a sweeping reorganization of the street system is impossible in any city. Attention must be given to the improvement of those arteries which have the most vital relation to circulation, and the improvement of which will result in the greatest benefits. Which streets these are in any community can be determined only after a survey of the entire traffic system. It is possible, however, to classify roughly the various types of streets according to their traffic uses.

[1] Tests by the Thermoid Rubber Company indicate that at 25 miles per hour the four-wheel brake reduces stopping distance from 58 feet to 38 feet 6 inches.

[2] Olmsted, Bartholomew and Cheney, *A Report on the Major Street Plan of Los Angeles*, p. 18, Los Angeles, 1924. In Los Angeles, for example, a practical test made on a number of principal streets indicated that the most efficient speed was about 22 miles per hour.

Every city possesses a number of streets, which because of their width, condition, location, or the districts which they serve, may be called *major traffic streets.* The major traffic streets are the skeleton upon which the city has grown. In all cities the major traffic streets include those thoroughfares which are generally called radials. These are the streets which distribute traffic from the main business center of the city to the subordinate business and industrial centers, and to the outlying residential districts. These radials are also normally the traffic ways which connect the street system with the rural highways. In the business district proper they are usually the main streets which carry, in addition to the traffic which they accumulate in the city at large, a heavy burden of commercial and interterminal traffic.

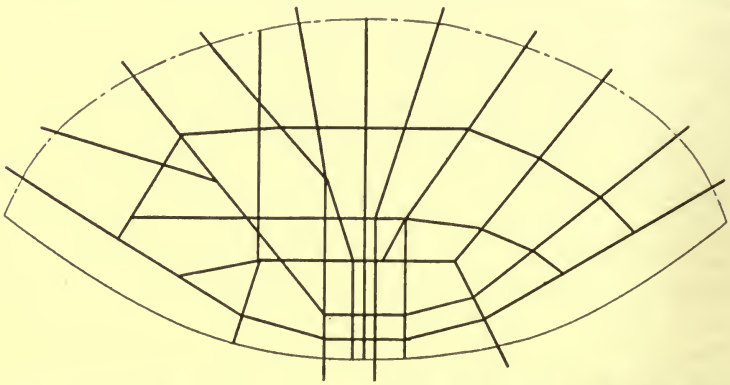

FIG. 5.—A street plan for St. Louis. This chart is taken from *A Major Street Plan for St. Louis*, p. 23, St. Louis, 1917.

Parallel to the major streets, or crossing them at intervals as they extend out from the center of the community are *minor streets.* Because of their width, continuity, condition, or the districts in which they are located, they do not act as the main traffic arteries, but serve to collect and distribute the burden which is carried by the major streets.

In addition there are certain streets in a city which because of their location serve as routes which may be used to divert traffic passing from one part of the city to another, around the heavily congested business district. These streets may be called *circuit streets.*

This last class of streets deserves the first attention, and an important place in a program of street improvements for traffic

relief. Some cities already possess good systems of circuit streets. In Washington, D. C., for example, it is possible for traffic to go from one part of the capitol to another on the diagonal streets and thus avoid the business district without greatly adding to the mileage. Likewise in Detroit, Grand Boulevard serves as a diverting thoroughfare. All cities, even those built on a rigid rectangular plan, possess streets which could be organized into a traffic *quadrangle*, and if properly improved would relieve the congested portion of the city of unnecessary through burden which it must now carry. Such quadrangle streets may serve not only as useful arteries for the diversion of traffic around the congested district, but when located in close proximity to the central portion of the city, may act as distributors and collectors for traffic entering and leaving the business district. Entering traffic seldom, if ever, finds that its destination is located on the thoroughfare by which the vehicle approaches. If the driver waits to change to the proper street until he is in the center of the city he adds unnecessarily to the congestion already existing. Circuit streets of ample width surrounding the congested area would encourage drivers on the entering radial streets to shift to their proper streets before entering the crowded district. In this manner much of the present unnecessary mileage on the business streets would be eliminated.[1]

In some cities the establishment of such a system of quadrangle distributor streets would require considerable replanning. In the great majority of communities, however, where the conventional rectangular street plan prevails the benefits of the plan can be obtained to a considerable degree by selecting existing arteries for the quadrangle, making them more attractive to drivers by improving the pavement and removing parked vehicles and other obstructions.

Secondly attention should be paid to that portion of the *major traffic street* system which lies in the congested area. This part of the improvement program is of course the most expensive, and it is not anticipated that very extensive widenings can be undertaken in the larger cities. In practically all of the larger communities in the country this part of the street system becomes saturated with vehicles by the mid-morning of each business day, and is not relieved until the afternoon out-rush

[1] Olmsted Bartholomew, and Cheney, *Report on a Major Traffic Street Plan for Los Angeles*, p. 40, Los Angeles, 1924.

of traffic. With this situation in mind there appears to be no particular advantage in increasing the capacity of the radials which lead into the congested area: already they bring in more traffic than can be cared for effectively. To increase their capacity by widening would merely result in their carrying a heavier peak load which could not be distributed effectively by downtown business streets. It seems logical, therefore, that the improvement of the major streets should begin at the center of the community and work outward only so rapidly as relief from congestion can be obtained in the business district.

Finally attention may properly be paid to the minor streets. As their name indicates they play a relatively unimportant part in the traffic system. Many of them already possess a capacity greater than the demand made upon them. In every city, however, there are some minor streets which if properly improved could serve as satisfactory auxiliaries to the major traffic arteries.

Cutting New Streets.—It may be found that the existing streets are so arranged that even with extensive widenings they will not serve the purpose, in which case it is necessary to consider the cutting of new streets.

One of the most extensive new street developments is the Fairmount Parkway recently completed in Philadelphia. This boulevard has been designed for its aesthetic value as well as for its bearing on traffic. It affords a diagonal route across the present street system from the city hall to the southern end of Fairmount Park, a distance of 6,300 feet. For half of its length the boulevard is 240 feet wide and for the remainder 140 feet wide. The plans make provision for a roadway 80 feet wide the entire distance of the parkway, the remainder of the space being utilized for walks, planted strips, and minor roadways. The significant point in the Fairmount Parkway construction is the fact that it is laid down as a diagonal on a gridiron street plan. This is an expensive type of improvement for it leaves irregular-shaped parcels of land. It has the very great advantage, however, of affording a radial street which shortens the distance of travel between the residential and business districts.

If the streets of the future are to prove more satisfactory than those of the present it is necessary that cities, and especially those which are growing rapidly, should make adequate plans for the opening of new streets in the suburban districts. The city

planning board should be given control over the dedication of new streets, and standards regarding their width and location should be laid down.[1] Real estate subdividers cannot be expected to realize or care for the traffic needs of the future to such an extent as do those who are charged with planning the streets for the entire community.

Closely associated with the cutting of new streets for greater traffic capacity, is the provision of connections between the segments of already existing streets. Not infrequently a short connection of a few blocks in length will convert a street which is at present practically useless for through traffic, into a major thoroughfare.

Alleys are very humble traffic ways, but they play an important part in the relief of street burden. In those cities where all goods entering and leaving business houses must be passed over the sidewalks to and from waiting trucks, the lack of alley space is keenly felt. Where conditions make it possible the construction of an alley in a business district may readily offer greater traffic relief than would a similar widening of a main street. Suitable alleys make it possible for heavy commercial vehicles to be removed from the streets, thus affording relief not only to vehicular congestion, but as well to that which exists on the side-walks.

Widening by Taking from Abutting Lots.—When it is found desirable to provide for additional traffic lanes in an existing street there are several methods which offer themselves. No one method can be said to be best for that is a question to be determined entirely by local conditions, and especially by the element of relative cost. When the street passes through a district which is relatively unimproved; where the buildings are comparatively cheap, or where they are a sufficient distance back from the property line so that they will not be damaged by the proposed widening, the most common method is to take the necessary space from the abutting lots. This practice, however, becomes

[1] *New York Times*, sec. 20, Jan. 7, 1923. The need for the careful planning of new streets is discussed by Commissioner Richard Enright in connection with the expansion of the Borough of Richmond in New York City: "If no definite plans are made, it will be built up in the same haphazard manner as the other boroughs. All this points to the need of a permanent body which shall be imbued with a vision of the growth of the city and which shall be charged with the duty of outlining new thoroughfares according to the ever-changing requirements of the city."

almost prohibitive in cost when it necessitates the demolition of expensive buildings.

Widening by Taking from the Sidewalks.—Another type of widening which is perhaps the least expensive of all is accomplished by moving back the curbs and thus taking from the sidewalks the area desired for the roadway. This method is of necessity limited to those localities where the walk space is more than ample for the pedestrian demands, or where it is possible to increase the sidewalk space by the removal of encroachments which have been placed upon it by the city or by private owners. Special care should be exercised where this method is used to see that the pedestrian area is not too restricted, for otherwise traffic movement will not be assisted. Too great density of pedestrian flow inevitably results in the walkers taking to the street thereby creating hazards for themselves and obstruction to vehicular movement.

Widening by Building Line Set-backs.—A third method for widening streets is that whereby new building lines, to the rear of the existing lines, are established by law. New buildings must keep to the new line, and old buildings which are to be renewed or substantially repaired, must be made to conform to it. In this manner the city is not forced to pay for damages to expensive buildings but can wait until the structures have conformed to the new line, or have become of such slight value that the damages will not be excessive. Such a procedure is of necessity slow, but such great economies are effected that improvements in streets can be made which could not otherwise be undertaken.[1] The chief drawback to the method lies in the fact that an irregular and unsightly building frontage is created for a considerable length of time. It is probably more desirable to complete the improvement at one time, thus permitting all property owners to benefit immediately, and to spread the payment of assessments over a period of time equivalent to that which would have elapsed before the widening took place under the setback plan.[2]

For newly developed districts the establishment of building lines has obvious economies and advantages. Until such time as these localities are well settled and heavy traffic develops,

[1] WILLIAMS, F. B., "Law of City Planning and Zoning," p. 181.

[2] BARTHOLOMEW, HARLAND, "A Major Street Plan for St. Louis," p. 33, St. Louis, 1917.

wide streets are an unnecessary burden both because of their original cost and subsequent maintenance. Unless provision is made, however, the erection of buildings may make later widening costly. A simple remedy is to establish a building line inside the property line beyond which construction cannot take place. In this manner the original narrow roadway can be widened to meet increased traffic demand, and with but slight expense.[1]

The Use of Arcaded Sidewalks.—Another method for increasing roadway area is by the use of the arcaded sidewalk. By this plan the roadway is extended to the full width of the existing street, and the sidewalks are placed in arcades in the abutting buildings. The chief advantage of this plan lies in the fact that it offers an alternative to the expensive process of condemning buildings. The only cost involved is that for obtaining an easement for the arcade and that needed for its actual construction.

There are several examples of arcading in America. One is to be seen at Madison Square Garden in New York City where the sidewalk on the easterly side of Madison Avenue between East Twenty-sixth and East Twenty-seventh Streets is carried under an ornamental awning of stone. This is not a true type of arcade, however, for the building proper does not extend over the sidewalk. It indicates, nevertheless, the feasibility of such construction.

The best example of arcading is probably that in Philadelphia where Fifteenth street and South Penn Square were widened by setting the sidewalk under the abutting building in an attractive arcade. This arcade has a total length of 335 feet and was built at a cost of $193,000 in damages for easement.[2]

An interesting proposal for an arcade was made in connection with the matter of widening Vesey Street between Washington and West Streets in New York City. The owners of the property

[1] For the advantage of the setback to property owners see WILLIAMS, p. 182.

[2] That the plan is not always inexpensive is indicated by a study of the City Planning Board of Boston, *Eighth Annual Report, City Document*, 8, p. 35, Jan. 31, 1922. "The distance suggested in the order of the City Council is approximately 3,400 feet in length. An arcade ought not to be less than 20 feet in width. This would mean land-takings of about 16,000 square feet" at an estimated cost of $17,000,000 which with construction costs would bring the total to $22,500,000.

proposed that if the city would consent to abandon the proposed change in the street width they would consent to the construction of an arcade through their building, with a sidewalk width of 17 feet and a height of 18 feet. The private owners also agreed to construct the arcade and to maintain it without cost to the city. The proposal received the unqualified endorsement of the chief engineer of the Board of Estimate and Apportionment.[1]

The arcading method affords an opportunity for much street widening that otherwise would be impossible. It is not unreasonable to believe that many property owners, especially where floor space is valuable would prefer to make a similar concession to the city rather than have their buildings condemned to the depth of the proposed widening. Some merchants have in fact already provided arcades in order to increase the show window area.

It is objected that the arcade is a disadvantage to merchants in that it tends to darken their shops. However in most cities the shops are at present chiefly lighted by artificial light, and for certain classes of shops shade is a considerable asset as it affords protection to materials in the display windows.

From the standpoint of traffic movement the arcade has an advantage in addition to the fact that it makes increased roadway possible. The use of the arcade makes possible a certain amount of separation between pedestrian and vehicular traffic, for it would be possible to construct the arcades in such a manner that it would be difficult for walkers to get into the street except at designated openings.

From the pedestrians standpoint the arcade has numerous advantages: he receives a certain amount of protection from passing vehicles; and he is afforded at all times a walking space protected from the elements.

The construction and maintenance of arcaded sidewalks present no serious problem. They could be lighted by the city, and could be policed as easily as the present sidewalks. The construction could be maintained by the public authorities in order to insure greater uniformity, and cleaning could be carried

[1] Tuttle, Arthur S., *Report* 24309, to Mayor Hylan, New York City, Mar. 28, 1923. This report includes an excellent summary of the chief foreign and American examples of arcading.

out by a joint agreement so as to provide against the infringement of one tenant upon the rights of another.[1]

Similar to the sidewalk arcade which has been discussed is the internal passage way or arcade built into the buildings proper. As street congestion increases it seems reasonable to believe that designers of buildings will find it desirable to make greater provision for such passageways. If they were so arranged, as they are in a number of cases, that connections can be made with similar passages in adjoining buildings, a continuous walk is made possible through the entire block.

A proposal for an elaborate arcade of this type was made in Boston some years ago and received the support of several eminent architects.[2] The proposal in brief called for the construction of a pedestrian thoroughfare to be built through existing alleys, narrow streets, and buildings for a distance of approximately eight city blocks. Plans were made for a walkway, enclosed except at cross streets, 20 feet wide and 25 feet high. Provision was made for the location of shops and offices opening into the passageway.

Double Level Streets.—Frequently proposals have been made in American cities for the double-decking of those streets which have become most congested. The plans usually call for the erection of a steel or reinforced concrete structure similar to that erected for elevated railways, with provision for ramps connecting the elevated way with cross streets. The elevated street is to be used in most cases exclusively by light, high-speed, motor traffic.

The arguments in favor of the plan are that it will double the useful traffic area of the street; that it will make rapid movement of traffic possible because vehicles on the high level part of the

[1] City Planning Board, *Plan of St. Paul*, p. 38, 1922. "By far the simplest method in the case of Seventh Street for adding to roadway and sidewalks is by acquiring an easement behind the building line for about 25 feet (part of which will be required for building columns) and setting the curbs about 7 feet closer to the building line than they now are. This will add a line of roadway traffic in each direction and will provide 3 feet of sidewalk outside the building and 25 feet of sidewalk within the buildings. Street lighting can be accomplished from brackets over the 3-foot sidewalk space or in the scoffits between the columns, since there will be no further need of awnings, which otherwise would interfere with proper light. The advantage of shade with this plan is apparent, particularly on that side of the street whose values are low because of the lack of it."

[2] Pember, John E., *Boston Herald*, p. 12, July 23, 1923.

street will not be delayed by cross traffic; that pedestrians will be kept out of the traffic flow with resultant decrease in hazards, and that the plan will make possible the very desirable separation of fast and slow vehicles. All of these elements are important in traffic movement and safety, and it is not impossible that the double-level street may be used to advantage under certain conditions.

However, it should be pointed out that there are certain very grave disadvantages to be found in this type of improvement. In New York, Boston, and Chicago the inconvenience of having elevated structures in the streets is well understood. They tend to render the streets on which they are built undesirable for business purposes, and thus threaten to bring about a lowering of property values; the supports for the structure afford considerable obstruction in the street area; and they darken the street and tend to render it unsanitary by decreasing the supply of light and air. Another problem of considerable difficulty is that of providing connections for the elevated street. Extensive alteration would be necessary to provide ramps of adequate width where the cross streets are narrow. All elements considered, the difficulties and problems connected with the building of double-level streets are so great as to create a presumption against this plan until other remedies have been exhausted. Not the least of the disadvantages of the double-level street as a means of increasing traffic area is to be found in the cost of construction. It is estimated that this would total $929,808 per mile, exclusive of property damage, unusual soil conditions, and ramps for intercommunication, each of which would cost approximately $55,000.[1]

There are several interesting examples of streets in the United States which have been double-decked for short distances though the result has usually been incidental to some other street change. As illustrations there are the Riverside Viaduct crossing Manhattan Valley in New York City, and the Twelfth Street traffic way in Kansas City. In both of these cases the double level resulted from the construction of a viaduct which did not make impossible the continued use of the original street beneath. Another interesting example is to be found in Chicago. Michigan Avenue for several blocks north of the Chicago River bridge

[1] Olmsted, Bartholomew, and Cheney, "A Study of a Major Street Plan for Los Angeles," p. 20, Los Angeles, May, 1924.

is raised above the old street level. The original thoroughfare on the lower level connects with the cross streets, and its use for trucking has been facilitated by the provision of a lower deck on the bridge. A very desirable elimination of heavy, slow-moving, commercial traffic from the avenue has thus been brought about, and this with the freedom from cross flow has resulted in a high average speed of traffic movement for the length of the elevation. The project was completed in 1920 and is said to have paid for itself many times over. Chicago has also made a start in traffic segregation by a two-level street around the Loop District. This plan will convert South Water Street into a double-deck street, and will provide a low-level by-pass for trucks between railroad terminals, and a high-level roadway for fast traffic. The rise of land values resulting from improved transit facilities, and the covering of unsightly freighting movement, is expected to repay the cost of construction.[1]

Vehicular Tunnels.—The vehicular tunnel is another method whereby the area available for traffic can be increased. As a means of cutting thoroughfares through hills, the traffic tunnel is well known in this country, and offers a very necessary and desirable type of improvement for those cities in which the hills necessitate heavy gradients on the principal streets.

In San Francisco the Stockton Street tunnel carries traffic from the shopping district to the Chinatown region and to industrial and residential districts beyond. In Los Angeles the Broadway tunnel carries the major street of the city through the hills lying to the north of the congested region. The Broadway tunnel is paralleled by the Hill Street tunnel which provides a double tube—one for vehicles and the other for street cars. The Second Street tunnel is one of the most extensive constructions of this type in America, and affords another thoroughfare through the hills which have in the past seriously cramped the traffic system of the city.

The growing use of rail subway systems, and the success and safety of this type of construction, has led many to believe that similar subways would be desirable for the use of vehicles. New York and New Jersey have taken the lead in the construction of the Hudson River vehicle tunnel. This tunnel which is now being driven under the bed of the Hudson River will connect

[1] Bibbins, J. Rowland, *Proceedings New York Railroad Club*, p. 7013, New York, 1923. See also E. S. Taylor, *Annals*, pp. 224–231, Nov., 1924.

New York City with the New Jersey shore. There will be two tubes having a length of 9,250 feet, each with an outside diameter of 29 feet, 6 inches, and each provided with a roadway 20 feet in width. The maximum gradients on approaches at each shore will be 3½ per cent.[1] In Boston it has been proposed that a vehicle subway be constructed under the Public Gardens

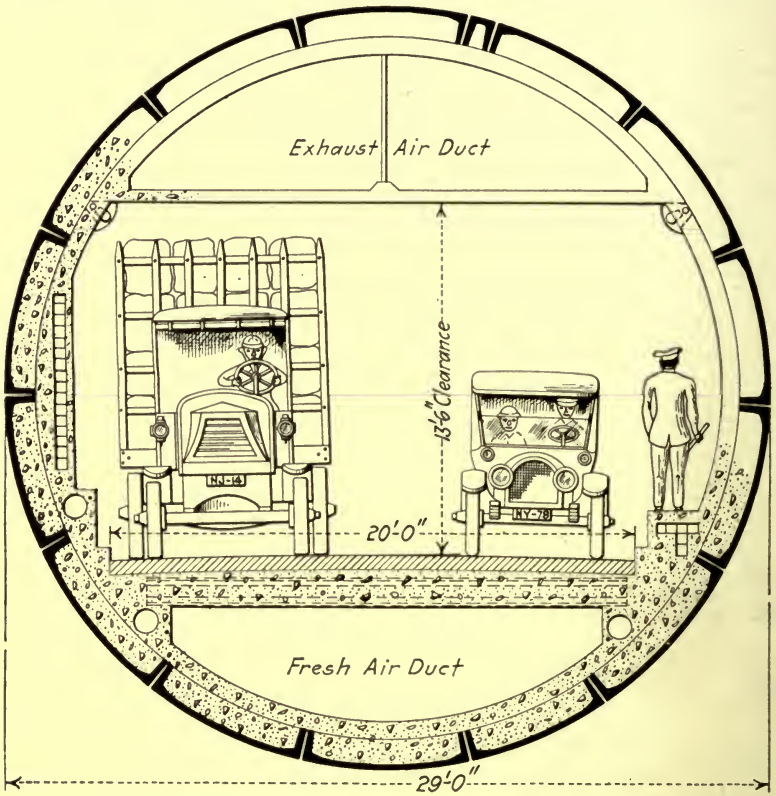

FIG. 6.—Cross section—Hudson River Vehicular Tunnel. This chart is taken from the *Report of the New Jersey Interstate Bridge and Tunnel Commission* (Trenton, 1920) Plate No. 16.

and Common, connecting the Back Bay region with the commercial district, and thus making it possible for vehicles to avoid the congestion on the shopping streets. The expense of the plan has kept it from gaining wide approval.

[1] For a complete description of this undertaking see, *Report of the New Jersey Interstate Bridge and Tunnel Commission*, Trenton, 1921; and *ibid.*, 1920.

The tunnel offers some of the advantages of the elevated roadway by providing a thoroughfare free from grade intersections and pedestrian obstruction in which it is anticipated a relatively high speed of movement can be maintained with safety. It has a comparative advantage in that it does not disfigure or limit the use of existing streets. However, it does raise the problem of ventilation. If vehicles are to move through a subway under their own power—and other means of propulsion have been found unsatisfactory by engineers who have studied the problem—provision must be made for the disposal of the exhaust gases from the motors. That the problem is not an insuperable one is indicated by the tests carried on in connection with the Hudson River tubes.[1]

A proposal which combines the idea of the elevated roadway and the traffic tunnel is that set forth by Richard E. Enright, Police Commissioner of New York City. The plan calls for an elevated roadway approximately 100 feet in width to be cut through the existing blocks of buildings from Harlem to the Battery. The headway would be about 16 feet, thus taking up the space between the second and third floors of the buildings through which it passes. "The roadway would run directly through the buildings in its path as if a giant knife had scooped out a space 100 feet wide and 16 feet high, one floor above the street level."[2] According to the plan the roadway would be carried over the cross streets by ornamental structures, and provision would be made every six to ten blocks for ramps connecting with the existing streets. Local and express traffic would be separated, and the latter would be required to move at a comparatively high rate of speed. In favor of the plan the arguments are advanced that it would cost less than the widening of existing streets which would entail the reconstruction of existing building fronts, and that it would reduce intersection conflicts. Many difficulties are to be anticipated, however,

[1] The ventilation plan for the tunnel provides for a fresh air-duct running along the lower section of the tunnel with frequent outlets through which air can escape into the tunnel proper. The air rises through crevices in the floor of the passageway under pressure. The gases are drawn out through a duct in the top of the tunnel. In an experimental tunnel this ventilation system was successful in keeping the proportion of 4 parts of carbon monoxide to 10,000 parts of fresh air.

[2] For a fuller description of the plan see *New York Times*, sec. 20, p. 1, Jan. 7, 1923.

for the ground floor heights of buildings vary, and in many cases the second story height would not be adequate to accommodate the roadway. Moreover, it would be necessary in many cases to reconstruct the buildings in order to reduce vibration and provide an adequate support for heavy traffic.

Financing Street Improvements.—Any type of street change is expensive and the more elaborate plans call for the expenditure of huge sums of money. For example, it is estimated that the intermediate thoroughfare proposed by the Boston City Planning Board would cost from $35,000,000 to $50,000,000. No matter what the benefit to the public there are few cities which can undertake such large improvements in any one financial period. This fact emphasizes the necessity for making plans in advance and for bringing them to completion in instalments.

In the future it is not unreasonable that the cities should look to the states for some assistance in the financing of street improvements. During the last two decades the states have expended large sums for the construction of highways. Some city thoroughfares are quite as important to the state at large as are rural highways. At present municipalities must, in many cases, provide traffic ways which are used to no small extent by through traffic passing from one part of the state to another. With the increased revenue received by the states from registration fees, from fines and penalities, and from such sources of revenue as the gasoline tax, it seems fair that municipalities as well as counties should have allotted to them some share of this money for their street improvements, which would serve to facilitate general as well as local traffic.

When the entire cost of replanning must be borne by the community the question naturally arises as to how the improvements can be financed so that it will be possible to proceed as soon as possible with the changes, and so that the costs will be distributed in the most equitable manner. There are three general ways in which the cost of street improvements can be met:[1]

1. The cash or credit of the entire community can be used.
2. The entire cost of the improvement can be raised by a special assessment against the owners of abutting property.
3. The two methods can be used in conjunction.

[1] Lewis, Nelson P., "The Planning of the Modern City," p. 360, New York, 1916.

That part of the first method which anticipates the borrowing of money on the credit of the community is attractive and not entirely unjust. It is argued, for example, that by the issuance of bonds the city may proceed immediately with improvements which would have to wait for many years if they were to be paid out of the current revenue. Moreover, it is claimed that streets offer a permanent investment which will be of as great advantage to future generations as to the present, and that therefore it is proper to pass on a part of the burden for their construction. Any street, it is said, forms an integral part of the entire traffic system of the city and therefore the community as a whole should bear the cost of its improvement. If the improvements are to be made by the use of the community credit the taxpayers of the entire city will have to raise the debt eventually through tax payments.

However, it is obvious that the taxpayers of the entire community do not all benefit equally by a street improvement. Those whose property is far removed from the improvement benefit less than those who own abutting property. This last class of owners who receive a clear benefit from the changed conditions should in justice be required to pay something for their special benefit. Wherever it is apparent that there is a measurable local benefit—and it is always present in an intelligently planned improvement—there should be a local assessment.

The chief difficulty in connection with special assessments is to be found in avoiding injustice, for all owners of local property do not benefit to the same degree from a street change which results in greater traffic capacity. This difficulty is rendered less dangerous by a careful study of local conditions. Such a study will reveal the amount of benefit accruing to abutting owners, and to those in less close proximity to the thoroughfare. An assessment district can then be arranged for the allocation of the varying benefits. How extensive this district should be will depend upon the importance of the street to the traffic system as a whole. It seems reasonable that the district should include all properties which by reason of the widening or extension are given an easier means of access and communication with the more important parts of the city.[1]

[1] Bartholomew, Harland, "A Major Street Plan for St. Louis," p. 29. St. Louis, 1917.

The method used by the City of New York in financing the Seventh and Varick Street improvements in 1913, at a total cost of approximately $5,000,000, illustrates the principle of the assessement district. Of the total cost the following percentages were distributed to the classes of property indicated:

12 per cent to abutting lots 100 feet deep.
33 per cent to a special benefit district.
40 per cent to the entire Borough of Manhattan.
11 per cent to the entire Borough of Brooklyn.
4 per cent to the entire Borough of Bronx.

Nelson P. Lewis has devised an interesting plan whereby the proportion to be paid by the various parts of the community can be determined by the character of the improvement. "While no definite rule can be adopted to govern the distribution of assessments representing the district and general benefit, it should be possible to prescribe a method of determining the amount and extent of local benefit, particularly in the case of new streets, boulevards, and parks. Let us assume that 60 feet is the maximum width required for a local street; then the entire cost of acquiring and improving all streets 60 feet or less in width may properly be placed upon the property within a half block on either side of the street. In the case of wider streets, that proportion of the cost represented by the ratio which 60 feet plus 25 per cent of the excess of 60 feet bears to the width of the street would probably be an equitable proportion to assess upon the local district. Up to a certain limit, property fronting a wide street is more valuable, and it would manifestly be unfair to adopt a rule which would result in making the cost of acquiring a street 70 or 80 feet wide no greater or possibly less to the abutting owner than would have been the cost of a street 60 feet wide. On the other hand, after a street reaches certain proportions, additional width will not involve additional benefit. It may be assumed that a share of the expense which would be equivalent to paying for a street 80 feet wide would represent the limit of local assessment. This limit would be reached under the rule proposed when the street becomes 140 feet wide. The percentage of cost which would be locally assessed would, therefore, be as follows for various street widths.[1]"

[1] "The Planning of the Modern City," p. 370, New York, 1916.

Width of street, feet	City's share, per cent	Property's share, per cent
60	..	100
70	11	89
80	19	81
90	25	75
100	30	70
120	38	62
140	43	57
150	47	53
200	60	40

It is clear that the above proportions may not in all cases be equitable, as where a narrow street, but one which is of great importance to the through traffic of the city, is widened to only 60 or 70 feet. However, it is believed that the schedule gives a satisfactory and equitable adjustment for average conditions.

If the proportion which is to be paid by the city is small it may be possible to meet the cost out of current revenues. Where the costs are so large that they cannot be carried by the current revenue it is necessary to meet them through borrowing. As a general policy of sound financing, bond issues should not be for a longer term than the life of the improvement. The extension or widening of streets, however, differs from such an improvement as paving; the increased capacity does not wear out or deteriorate but continues as a permanent and lasting benefit to the future citizens of the city. It would seem reasonable, therefore, that in the case of bonds for street widenings, the issue should be for a longer period than would be considered justifiable for the construction of perishable improvements.

Where the sums to be assessed for local benefits are very large, opportunity should be made for payment in instalments covering a period of years. In this manner the owners will be subjected to no undue hardship, and they may be assisted in the payments by the benefits which have accrued to their property. During the interval of these instalments short-time securities can be issued by the city in order that funds for the work may be had immediately.

CHAPTER VI

MINOR CHANGES TO INCREASE STREET CAPACITY

Street extensions and widenings are so costly that every attempt should be made to bring the existing streets to their maximum traffic capacity before major changes are undertaken. In all cities there are illustrations of improper street conditions which limit capacity.

REMOVAL OF PHYSICAL OBSTRUCTIONS

One of the most unjustifiable uses of a busy street is encroachment by individual users or the owners of abutting property upon its area. Streets are primarily intended for the movement of people and commodities, and to use them for other purposes is an infringement upon the rights of the public.

Sidewalks have perhaps suffered from encroachments to a greater extent than have roadways. Public officials themselves have frequently been guilty of placing obstructions which diminish the space which can be used by pedestrians. Fire hydrants, lamp posts, mail boxes, and rubbish cans are often so placed that they hamper free movement. It should be noted that such obstacles take up, in addition to the physical space which they occupy, an amount of sidewalk area required by the pedestrians to avoid them. Examination of foot prints immediately after a snowfall will indicate that the usable part of the sidewalk is restricted for a foot or more to each side of the space occupied by the obstacle, and that the restriction tends to continue for several feet along the length of the walk. The practice of placing hydrants in pits flush with the surface of the walkway is a partial remedy, and there appears to be no reason why the European practice of setting mail boxes into the building walls should not be followed.

Private encroachments upon the sidewalks are even less justifiable. The use of the street area for the extension of stoops,

the erection of signs, show cases, or loading platforms should not be permitted.[1] It seems reasonable that every city should require, as many cities have, the removal of such obstructions.[2]

The roadways have likewise suffered from obstructions. For example, the older type of elevated construction resulted in the placing of supporting columns in the roadway area. Boston, New York, and Chicago all suffered by having the capacity of some of their most important streets lessened in this manner. Their experience should serve as a warning to other cities which are contemplating elevated construction. One of the proposals of Borough President Julius Miller for an improvement of street conditions in Manhattan, was the removal from the roadways of the pillars of overhead railways. The report on the subject says:

"Sixth Avenue could carry at least as much traffic as Fifth Avenue were it not for the presence of street car tracks and 'L' columns in the roadway . . . Legislation will be sought for the immediate relocation of 'L' columns from the roadway to the sidewalk adjacent to the curb."[3]

A similar restriction to traffic movement is to be found in the use of center trolley poles for surface car lines. These poles serve to create hazards on the streets as well as to restrict their

[1] The extent to which such obstructions may monopolize sidewalk space is indicated by a survey made in the retail district in Boston. In a short distance there were found ten clocks occupying from 18.2 to 40.2 per cent of the width of the sidewalk; eight sets of posts of a private nature occupying from 5.8 to 25.6 per cent of the space; two hydrants occupying an average of 21 per cent of the width of the walk; and numerous fountains, fruit stands, open display windows, and flower stands, using from 15 to 50 per cent of the walk area. "These obstructions," the report indicated, "are so near together that at short intervals from 10 to 40 per cent of the sidewalks in Boston's most congested district is unavailable for pedestrians." Boston Chamber of Commerce, *Street Traffic Regulation in the City of Boston*, p. 36, Boston, 1914.

[2] Dillon, John F., "Commentaries on the Law of Municipal Corporations," vol. 3, sec. 1177, 5 vols. Boston, 1911. "It is a diversion of the public streets to a private use to use them *for fruit, candy, news, and market stands of all kinds*, particularly when it is done in such a manner as to cause substantial and permanent obstruction to public travel . . . The maintenance of these *market stands* is a public nuisance and indictable at common law as such."

[3] *Report of the President of the Borough of Manhattan*, pp. 7, 23, Feb. 14, 1923, New York.

use by traffic. The desire of some municipalities to preserve natural beauty has caused them to permit trees to remain in the roadways. Usually some attempt is made to signalize these obstructions, but at best they are the frequent cause of serious and fatal accidents.

CHANGES IN STREET CONSTRUCTION TO MEET THE REQUIREMENTS OF MOTOR TRAFFIC

Various conditions on the streets which result in delays and hazards have been touched upon in the chapter on causes of

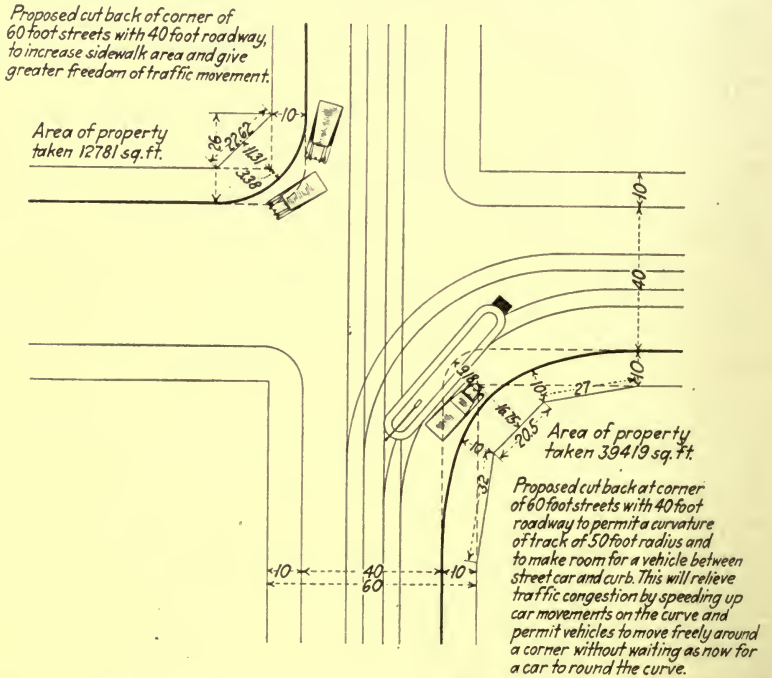

FIG. 7.—Example of redesigned curb returns. This chart is taken from the *Plan of St. Paul*, City Planning Board, p. 33, St. Paul, 1922.

congestion. Suggested remedies for these structural defects may be mentioned here. The surface of all streets where traffic is heavy should be provided with a type of pavement adjusted to traffic demands. The pavement should be smooth enough to permit a reasonable rate of speed. The texture of the surface should be such that the pavement does not become unduly

slippery in damp weather. Special attention should be given to this factor in the surfacing of streets with grades. The use of roughened asphalt or brick pavement under such conditions is desirable. Faced granite block pavement appears to be the most desirable for trucking streets because of its smoothness and durability. For shopping districts the wood block pavement has proved useful because of its quietness and comparative smoothness when kept in proper condition. It has an unfortunate tendency, however, to become slippery in damp weather and for this reason should be avoided on grades. Asphalt or asphalt composition surfacing continues to be the standard pavement for residential and boulevard streets.

When streets are regraded the crown of the roadway should be reduced as much as possible;[1] open or depressed gutters across streets should be covered; and catch basins should have their openings made flush with the street surface, or be set into the curbing.

The realignment of streets where there is an offset is desirable from the standpoint of traffic movement. The taking of a slight amount of property often makes possible a straightening, and if the necessity for the change be understood it can be made before buildings of an expensive character have been erected.

One of the simplest of street improvements, but one which serves to assist traffic in an important way is the cutting back of curbs at intersections. Traffic flows most readily when it can move in easy curves. Observation of the behavior of traffic at street corners indicates the effect of the short curb radius and the necessity for change. Automobiles with a large turning radius are forced to leave the curb in making the right-hand turn, and if the radius of the curb is very short, cannot enter the cross street without encroaching upon the left-hand side of the roadway. This difficulty is emphasized in very narrow streets.

The curb radius, theoretically, should be as great as the turning radius of the largest car using the streets.[2] Practically such a

[1] See *Report of the Committee on Construction and Engineering*, appointed by the Secretary of Commerce, pp. 12–13, Washington, 1924.

[2] SWAN, HERBERT S., *Engineering News Record*, p. 401, Mar. 1, 1923. "The minimum turning radius of the average car as measured along the center line of the machine is 21 feet . . . Most cars turn in a radius of from 17 to 27 feet. Most curb radii are, however, only 6 feet, or even less. They rarely exceed 12 feet."

setting back of the curbing is usually impossible, but it is an ideal which should be attempted in the construction of new streets. Where streets are heavily traveled, and where adjacent property is of comparatively low value it would seem desirable to set back the curb even where the change necessitates the taking of some private land for the purpose. In making a readjustment of the curbs in congested districts an equitable balance must be maintained between the demands of the roadway and

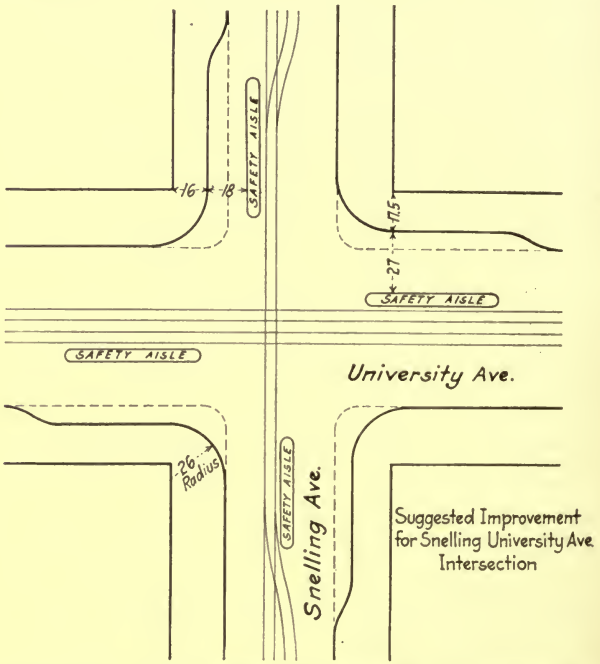

FIG. 8.—Intersection relief through splaying. *Plan of St. Paul*, p. 34, St. Paul, 1922.

the sidewalk. The setback should not unduly restrict the area available for pedestrians. A suitable curve can be obtained by taking as a radius the average width of the intersecting sidewalks. The greatest possible setback is especially necessary where there are right-turning trolley cars. The cars have an overhang which amounts to several feet in the larger types. Pedestrians standing on a projecting curb, or standing in the street by it, are imperiled by the turning cars, and accidents resulting from the crushing of automobiles between the street

cars and the curbing are not uncommon. A sufficient setback may also have the desirable effect of making it possible for street cars and motor vehicles to turn the corner simultaneously.[1]

Considering the demands made upon intersections they should logically have a greater area than the widths of the intersecting streets give them. In the intersection is concentrated the flow from the two or more entering streets; pedestrians use the street surface for crosswalks; space is usually taken for loading zones, and greater area is required by turning vehicles. These conditions, added to the consideration that the traffic capacity of the intersection tends to control the capacity of the crossing streets, point to the desirability of enlarging the area of the intersections wherever possible. One method of relief which may be termed "splaying" provides for the widening of the streets for some distance back from the intersecting street lines. This improvement has the advantage of reimbursing the roadway for the space taken for safety zones, and likewise makes possible a more effective handling of motors lined up at the intersection while waiting for release.

The rule which provides for the establishment of building lines from 10 to 30 feet back of the property lines would assist traffic movement. Cities have generally permitted buildings to be constructed to the corner of the property, thus making future enlargements of the intersection difficult, and creating blind corners which make rapid movement of vehicles hazardous.

The Building of Traffic Squares.—Focal congestion to be found at the convergence of several streets, at bridge heads, docks, warehouses, railway stations, and ferry slips, is a condition which demands some remedy. This is often to be found in part by a better regulation of traffic, but in other cases some change in the street plan is required. This problem has been met by the engineers of the new Hudson River vehicular tunnel by providing a traffic square or plaza at the entrances and exits to the tubes.[2] Congestion at approaches to bridges and tunnels is especially undesirable as it makes it impossible for strategic and costly traffic ways to be used to full capacity. The effect

[1] For a further discussion of this and allied subjects the attention of the reader is called to the *Report of the Committee on Construction and Engineering*, appointed by the Secretary of Commerce, Washington, 1924.

[2] *Report of the New Jersey Interstate Bridge and Tunnel Commission*, p. 30, Trenton, 1920.

upon adjacent streets is also undesirable for the congested traffic often backs up into them, and limits their usefulness.

Physical Changes to Reduce Conflicts in Moving Traffic.—Ideal traffic conditions would exist if every unit in the traffic stream could move from point to point without having its passage obstructed in any manner. While such a Utopian condition is impossible to attain, it is possible to make certain physical changes in the streets which will greatly reduce the number of conflict areas. It should be noted that in this matter the interests of traffic movement and traffic safety are identical. In the degree to which conflicts between moving vehicles and between vehicles and pedestrians are made difficult, to that degree is greater safety obtained.

One of the most serious types of conflicts between traffic units is that between rail and free wheel vehicles. The abolition of grade crossings is being agitated throughout the country. The change is costly, but the results in increased safety and freedom of movement appear commensurate. The amount of obstruction offered by grade crossings of railways and streets is indicated in a study of Los Angeles conditions made by Richard Sachse. It was found that delays to traffic at one crossing during a 14-hour period totaled 5 hours and 54 minutes, or in other words the gates were down 43 per cent of the time.[1]

Another illustration of grade crossing delays is given by Herbert S. Swan in the following statement regarding conditions in Paterson, New Jersey:

> How the free movement of traffic is interfered with by the railroad crossings is well illustrated by the conditions at Market Street and Erie Station, one of the busiest points in the city. On July 14, 1921, the gates at this crossing were down seventy-eight times for an aggregate period of 71 minutes between the hours of 8:00 a. m. and 6:00 p. m. This is at the rate of one gate every 7 or 8 minutes. It is the exceptional 15-minute period that does not have at least one gate. During some hours, the gates are down nine, ten, and even twelve times.

The conditions in Los Angeles and Paterson are typical of grade crossing delays in many other cities where the rail lines carry on switching operations through and across the streets. The degree to which grade crossings hamper traffic flow is not fully indicated, however, by the simple count of vehicles delayed.

[1] *Outline of Testimony before the Interstate Commerce Commission*, 14778, pp. 18–19, Los Angeles, July 5, 1923.

All cautious drivers in approaching a track, regardless of whether the gate is up or down, reduce their speed. Moreover, in practically all cities street cars are required to come to a full stop at all rail crossings even though there be a guard on duty. This is a very necessary precaution, but where the streets are narrow, the entire vehicular traffic stream is held up until the street car moves on.

A condition even more serious than that of the grade crossing is created when the tracks of the railway are laid along the length of the street at grade. "Death avenues" are created which cause constant danger to those who use the street, and great disturbance to traffic movement.

It is scarcely necessary to point out that the grade crossing is a serious disadvantage to the railroads. The rapid movement of trains is hampered when the greatest precautions are taken. Crossing watchmen must be retained, and expensive apparatus in the form of manual or automatic signals and safety gates must be installed. The damages which must be paid for crossing accidents is no small item. It appears that the increase in flexibility of train movements, and a reduction of the expenses now involved would materially offset the fixed charges incurred by grade separations.

There are a number of ways in which the elimination of grade crossings can be brought about. The viaduct method, whereby the street is carried over the track, is illustrated in practically every city, and is probably the least expensive plan.[1] It offers an especially desirable method where, in addition to crossing the tracks, the street must be carried over a stream.

The placing of the tracks in tunnels as in New York City affords one of the most complete solutions, and has advantages to the railroad in entirely freeing its right of way from obstruction. The great cost, however, is an element which makes this type of improvement impossible in most cities.

The elevation of the railroad right of way across the street plan, is the method which has been followed in Chicago,[2] and in a

[1] HUFF, CHARLES H., "Elimination of Grade Crossings," p. 6, St. Louis, 1920. "One of the most elaborate viaduct schemes is used in connection with the widening of Roosevelt Road in Chicago. This viaduct is 180 feet wide and 3,600 feet long. It crosses forty-nine railroad tracks at their entrance into the heart of the city."

[2] HUFF, CHARLES H., "Elimination of Grade Crossings," p. 6, St. Louis, 1920. "Chicago has 160 miles of main railroad track elevated to avoid grade

number of eastern cities. The objection to this plan from the standpoint of noise, is partially overcome by the use of the solid fill embankment, and by the reinforced concrete elevated structure which permits the use of a rock-ballasted roadbed. The objection will be further overcome as the electrification of railroads progresses.

The depression of the right of way of the railroad is another method. Where topographical conditions are favorable a relatively shallow open cut may be adequate to depress the track sufficiently so that a corresponding increase in the street elevation will make a separation possible.

The use of the undercut is another method for separation. This remedy is indicated where the tracks are somewhat higher than the general grade of the roadway, so that reasonable gradients can be kept in the street without the necessity for building long approaches. The use of this method is made difficult in closely built-up sections by the damage which may be done to adjacent property by a depression of the entire width of the roadway. Where there is a succession of grade crossings, the elevation of the tracks as in Chicago, or their depression as in Boston, seem to be the most feasible plans. Of all the cities in the country Boston has been perhaps the most successful in an elimination of grade crossings. This is partially due to the fact that the improvements have been carried on as a state enterprise during a long period of years.

A special commission is appointed for each project, being composed of three disinterested persons. This commission determines the necessity for the improvement and whether the construction should be undertaken by the state or the railroad company. The law requires that 65 per cent of the cost shall be borne by the railroad company, and the remainder divided between the city and the state, the former paying 10 and the latter 25 per cent. In case a street railroad company is directly involved in the project it may be required to pay 15 per cent, thus reducing the state's share to 10 per cent. The special commission also specifies the grades to be established, and the type of construction to be used. The law provides for the maintenance of the structures. The private companies pay for the

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crossings. There are ten lines of railroads in Chicago which are elevated from their point of entrance into the city to their terminals."

upkeep of the framework, flooring, and abutments, while the approaches and wearing surfaces are maintained by the city. Under this law more than $42,000,000 has been spent.[1]

A number of conditions tend to retard extensive grade crossing separation programs. Both private and public agencies hesitate to take the initiative lest they be forced to bear an undue share of the cost. It is in this connection that the Massachusetts law is effective, for it establishes machinery for the equitable distribution of the burden. There is also a general tendency for local property interests to insist that construction should be unduly elaborate and ornamental. Excessive costs ranging from $100,000 to $500,000 per separation make progress slow. Aside from aesthetic considerations there seems to be no good reason why relatively inexpensive timber construction should not be used in many places. In order that too great expenditures may not be involved in any one financial period a definite program should be undertaken for gradual accomplishment. In Los Angeles, for example, the Grade Crossing Commission has selected five crossings to be eliminated each year, beginning with those which experience has proved most dangerous.

The mingling of automobiles with street cars is another cause of conflicts which can be remedied under some conditions by physical separation. The protection of surface tracks along streets by curbing is useful on relatively wide thoroughfares in the outlying districts of the city where a considerable speed is maintained by both street cars and motors.[2] Even on streets in the more heavily traveled portions of a city this type of separation can be used with success as illustrated by the experience on Huntington Avenue in Boston. While the inability of motors to move in the space occupied by the car tracks limits the area of the roadway there are advantages which compensate for this limitation. Automobiles cannot crowd on to the tracks and block the approach of cars to their stopping places, nor in moving traffic can they cut in on the tracks creating hazards and delaying the movement of street cars.

[1] For a further discussion of this law and methods used in other cities see Huff, Charles H., "Elimination of Grade Crossings," p. 25, St. Louis, 1920.

[2] *Report of Committee on Construction and Engineering* appointed by the Secretary of Commerce, p. 10, Washington, 1924. "A reservation in the center of the street should be provided for the exclusive use of the street railway, with a one-way driveway on each side for vehicular traffic."

Grade Separation at Street Intersections.—Were it not necessary for the paths of vehicles to cross at intersections, traffic could move constantly and at a rate of speed limited only by the requirements of safety. The intersection affords the chief point of conflict, and any improvement in the physical arrangement of streets which promises to reduce this condition is worthy of the greatest consideration. Where a number of heavily traveled intersections occur in series, the use of the elevated street or vehicular tunnel may be advantageous.

Relief of intersection congestion by a separation of the grade of the intersecting streets is so expensive that it can be justified only where there is a crossing of great streams of traffic as: (1) where high-speed highway traffic is crossed by city traffic; (2) where there is a crossing of densely traveled major traffic streets carrying about equal volumes; (3) where there is a crossing of a major radial traffic street carrying heavy in- and out-rushes of of traffic, with a commercial street carrying a dense flow of slow-moving vehicles.[1]

Intersections of the first class, usually to be found only in suburban districts, are ordinarily at such infrequent intervals that the elimination of a single crossing is effective in increasing the capacity of the arteries for a considerable distance in all directions.

Intersections of the second class offer a more difficult problem, for important intersections are likely to be found at such short intervals that the separation of grade at a single crossing will not appreciably increase the capacity of the streets.

The most acute situation is that to be found in the third class of intersection. A slowing down of the speed of the in-town and out-town movement of workers lengthens commuting time and tends to restrict a desirable growth of outlying residential districts. Since most intersections of this type are comparatively near the center of the city, where every cross artery tends to become an important thoroughfare and an obstructing influence, it is probable that continuous elevation of the entering radials offers the ultimate solution.

Where it is desirable to separate street grades at a single intersection the end may be accomplished by use of either the sub-

[1] HUDSON, WILLIAM D., "Reduction of Traffic Congestion by Means of Street Grade Separation," *Major Traffic Street Plan*, p. 50, Los Angeles, Cal., 1924.

way or viaduct. The choice will depend upon the approaching grades, the width of the streets, the character of the neighborhood, and the amount of money available.

A street of 120 feet in width will permit the construction of a subway to accommodate four lines of traffic with sufficient space on the surface for four lines of traffic and for two sidewalks 18 feet, 6 inches wide. Subway construction on a street of such a width is not likely to result in heavy damages for it does not hamper ingress or egress to or from the property adjacent to the subway approach. In a 100-foot street a four-lane subway can

FIG. 9.—Park Avenue viaduct over Forty-second Street, New York City.

be constructed with room on the surface for four lines of traffic, and for two sidewalks 9 feet, 6 inches in width. An 80-foot street with a four-lane subway will permit two lines of traffic on the surface and two sidewalks 8 feet, 6 inches in width.

The cost of a four-lane subway, assuming level street gradients, may be estimated at approximately $270,000. Unfavorable soil conditions, special obstacles in the way of sewers and water mains, and ornamental requirements may materially increase the estimate. A viaduct of the same capacity designed for vehicles only will cost approximately $130,000. Whether the subway or

the viaduct is used approaches should not have a gradient of more than 4 per cent, nor should the clearance be less than 14 feet.[1]

The most interesting subway separation which has come to the attention of the writer is that in Detroit where Grand Boulevard is carried under East Jefferson Street. The improvement at this point seemed necessary inasmuch as both streets are heavily traveled, and especially as Grand Boulevard forms a direct approach to the newly constructed Belle Isle Bridge. Grand Boulevard is very wide and provides for ample traffic room on each side of the ramps which have been cut down in its center.[2]

One of the latest ventures in grade separation is to be found in San Francisco, where the Embarcadero is being undercut below the Loop at the foot of Market Street. The Loop is located in front of the Ferry Building, and carries the burden of the trolley cars which operate over the four-track system in Market Street, as well as a large number of vehicles destined to the ferries. Under the new plan heavy commercial traffic along the Embarcadero will pass under the Loop resulting in a complete elimination of conflicts.

Another type of physical improvement for the reduction of conflicts in moving traffic is that which brings about the division of the street into two roadways, each being used as a one-way street. This improvement can be introduced most easily on streets of considerable width. The division may be brought about by the erection of a simple curbing or walkway through the center of the street, or by providing for a parked area between the two roadways. Illustrations of this type of street development can be seen in portions of West Adams Street in Los Angeles, in Commonwealth Avenue in Boston and in Park Avenue in New York City. In each case a center parkway has been made in which trees and ornamental shrubs have been planted. A more pleasing treatment for a broad residential street cannot be obtained. From the standpoint of traffic movement there are also numerous advantages. Motors cannot turn in the street at mid-block; the location of the parkway at

[1] The author is indebted to William D. Hudson for these estimates.

[2] H. N. Esselstyn, the architect who designed the work and supervised the construction states that the total cost of the separation was $476,000. The width of the depressed roadway is 36 feet from curb to curb. The clearance headway under Jefferson Street is 12.2 feet, and the length of the subway portion is 172.96 feet. The approaches are each 417 feet in length and have a grade of 3.6 per cent.

intersections tends to make improper turning difficult, and most important of all, there is no opportunity for lines of traffic moving in opposite directions to come into conflict.

Physical Changes to Reduce Conflicts between Vehicles and Pedestrians.—Automobiles are not driven on the sidewalks no matter how dense the traffic. This is chiefly due to the fact that their construction makes it difficult for them to climb the curbings. Pedestrians have no such limitations. When the sidewalk becomes crowded, or when it suits the purpose of individuals, they mix freely with the moving vehicles in the

FIG. 10.—Pedestrian protective fence, Boston Common.

roadway. Regulations of a legal nature have been tried to limit the practice of jay-walking, but with little success. It would appear that some physical construction is necessary to make it as difficult for pedestrians to enter the roadway as it is for automobiles to enter the sidewalk space.

The establishment of suitable barriers to direct and limit the movements of pedestrians has many difficulties to overcome, and as yet no comprehensive plans have been devised. There are, however, certain constructions which have been used successfully in different cities. They may be considered under the following divisions: (*a*) fences, (*b*) subways, (*c*) elevated sidewalks, (*d*) safety zones.

The purpose of the *fence* is to direct pedestrians to designated crosswalks, and to make it difficult or impossible for them to cross the roadway at other places. One of the few examples of this type of directive barrier is to be found on the Boston Common. Formerly the Common was surrounded by an ornamental fence with occasional openings to the adjoining street intersections. Some years ago this fence was removed, but it was found that pedestrians streamed across Tremont and Boylston Streets in such a manner as to retard traffic. At present this fence is being reconstructed in parts in order that the flow of walkers can be directed to the regular street intersections where they can cross the street under the guidance of an officer.[1]

Another example of a pedestrian barrier is to be found in front of the Municipal Building in New York City. This is in the nature of a fence composed of a series of movable stanchions connected by ropes and bearing the signs, "Pedestrians Cross at the End of the Rope." This simple and inexpensive device has had a very beneficial effect in discouraging jay-walking, and in making it necessary for pedestrians to cross the street at places where the traffic officers can assist them, and synchronize their movement with that of the vehicular flow.

The beneficial results, which have come from decrease in accidents and increased speed of train movements from the enclosing of railroad rights of way, lead one to believe that similar benefits will be derived from a similar protection on major traffic streets. It is suggested that an ornamental railing along the sidewalk, approximately 2 feet from the curb, and provided with occasional openings for those entering motor cars, might be used to advantage on many streets. The most desirable place to try such an experiment would be on a street where the sidewalks

[1] Boston City Planning Board, *Eighth Annual Report*, p. 33, Boston, 1922. "It is the opinion of the City Planning Board that a fence along Tremont Street, from Park Street to Boylston Street, . . . set back a short distance (possibly 3 feet) from the new curb in order to facilitate the letting off and taking on of automobile passengers, with openings only at those points which might be designated by the Park Department or Police Department or such other municipal body as might be directly affected by the project, would be a very desirable improvement. Such a fence, with openings where considered desirable and necessary would assist in the correction of pedestrian movements by affording the traffic police a practical means of controlling the throngs of foot passengers who swarm across Tremont Street to the subway entrances and to the paths of the Common without regard to the street crossings."

are of greater width than is necessary for the present demand, and where it is desirable that motor traffic be expedited as much as possible. An inexpensive barrier such as that used in New York would be adequate to test the effectiveness of the scheme.

The pedestrian *subway* is another method for the reduction of conflicts by the separation of vehicles and pedestrians.[1] There are a number of examples of this type of structure in the United States. In Detroit, pedestrian subways have been included in the grade separation accomplished at the intersection of Grand Boulevard and East Jefferson Street. The passageway makes it possible for walkers to pass under Jefferson Street without coming into conflict with the surface traffic. Stairs connect the subway with the surface sidewalks, and the arrangement of the tunnel makes artificial lighting unnecessary during the daytime. In Chicago a pedestrian subway has been constructed under Michigan Avenue at Randolph Street making it possible for walkers to cross under this busy thoroughfare without danger or delay. The usefulness of this subway will be increased in the future when it is connected with the platform of the suburban railway station. In Pasadena, a pedestrian subway has been constructed under Huntington Drive at Fremont Street, making it possible for walkers to avoid crossing the four-track interurban railway, and the rapidly moving traffic on the Drive. A somewhat different type of tunnel is to be found in Boston in the passageway which connects the Boylston Street subway station with an office building on the opposite side of the street. Thousands of pedestrians use this tunnel daily to the great relief of one of the busiest street intersections in the city.

In addition to these relatively short pedestrian passageways under street intersections it is frequently suggested that longer and more elaborate underground walks should be built. For example, it is proposed that the loading platforms of the present subway systems should be extended and connected by walks

[1] MILLER, JULIUS, *Annual Report of the President of the Borough of Manhattan*, p. 25, New York, 1923. "At Fifth Avenue and Thirty-fourth street, pedestrians are constantly being crowded back to the sidewalks where they must wait, much to their annoyance, for the passing of vehicles before they can attempt a safe crossing. It is proposed to provide an attractive underground passageway directly beneath the street intersection for the sole use of pedestrians. Pedestrian traffic then will be able to cross the street in any direction without delay and inconvenience, in absolute safety."

parallel to the tracks.[1] On these underground walks show windows and shops could be established, and entrances could be made to the basement floors of the adjacent buildings.

Such underground walks would serve to relieve the street burden to some extent, but they have numerous disadvantages. They tend to keep the people away from the light and air, and in surroundings which, under the most favorable conditions, are not as healthful as they should be. Moreover, the cost of all subterranean construction is high. The usefulness of the inter-

FIG. 11.—Pedestrian bridge, Pasadena, Cal.

section subways is lessened by the fact that they are not popular. Where they have been installed the writer has observed that they are used by only a small per cent of the people who cross the street. This condition is partially due, no doubt, to the necessity for descending and ascending a flight of stairs. It has been suggested that this objection to their use can be overcome by the installation of escalators.

The use of *elevated sidewalks* and sidewalk bridges affords another method for the separation of pedestrians and vehicles. Proposals for elevated sidewalks usually call for the erection of a

[1] MILLER, JULIUS, *Annual Report of the President of the Borough of Manhattan*, p. 23, New York, 1923. "It is proposed to convert a portion of the old subway between the Grand Central Terminal and a point west of Fifth Avenue into a street below the present street level for pedestrian use only."

walkway immediately over the existing sidewalk, supported by pillars from the curbing, or by brackets to the sides of the adjacent buildings. The plans generally contemplate the construction of show windows and entrances to stores at the second-floor level. The chief advantages of the elevated sidewalk in addition to the extra street space afforded lie in the fact that it would make it impossible for pedestrians to cross the street in mid-block, and that at intersections the walkers could travel over the street surface by means of bridges. There are many examples of such bridges or crossovers in railway practice, but few experiments have been tried on the streets. The most interesting illustration is to be found in San Francisco, where a pedestrian bridge has been built from the upper landing level of the ferry building across the Embarcadero to the foot of Market Street. The walk carries thousands of pedestrians daily over a heavily congested traffic area. Its popularity with the public is to be found chiefly in the fact that passengers using the upper level in the ferry building can use the walk without any additional climbing or descending of stairs. When the Embarcadero vehicular undercut is completed there will be three levels of traffic at this point; pedestrians on the elevated walkway, street cars and motors on the street surface, and the Embarcadero traffic in the subway.

Where conditions of pedestrian congestion and interference become so severe as to necessitate new construction of this type it is believed that the *second-story arcade* affords a more desirable and permanent solution than the elevated sidewalk. In design this arcade could be precisely the same as that suggested for the street level, with the exception that it would be set into the buildings at the second-story level. The protection afforded pedestrians would be the same as in the former type. As compared with the elevated sidewalk it would have the advantage of keeping the street entirely free from elevated obstructions, and the effect would be more pleasing. It would make possible the conversion of the entire street width into roadway, with the exception that provision would have to be made for narrow loading platforms along the building lines, for the use of those entering and leaving the buildings by motor. The existing ground-floor entrances could be retained, and no internal rearrangement of the buildings would be necessitated beyond that necessary to construct the arcades and second-floor entrances open-

ing from it. At intersecting streets the arcades could readily be connected by ornamental bridges, as in the case of the elevated sidewalks, making it unnecessary for pedestrians to descend from the upper level until their business in the district had been completed. It may be pointed out that with this type of construction opportunity is offered for the provision of truck entrances to the ground floor, and the greater use of interior loading and unloading facilities. Where conditions favored, it would be also possible to provide storage space for waiting motors on the ground floor. The suggestion for the second-story arcade may seem somewhat visionary, but it is no more so than plans which contemplate the erection of elevated streets, or the construction of new streets through existing buildings. It offers advantages which deserve the serious consideration of cities where extensive physical changes in the streets are required.

The *safety zone* affords another means for the reduction of vehicular and pedestrian conflicts. As its name indicates it was originally designed for the greater safety of pedestrians in crossing thoroughfares, and this continues to be its chief use. Its value from the standpoint of traffic movement, however, is great. Where safety zones are not used pedestrians tend to become confused in crossing wide streets, and drivers must reduce their speed of movement in order to avoid accidents. The lack of safety zones is especially felt at points where street cars stop. Persons wishing to board the street car enter the roadway and gather in groups at the place where the cars normally stop. These groups often occupy so much of the roadway that it is impossible for automobiles to pass until the street car has moved on, or if they can pass they do so only at greatly reduced speed, and at considerable hazard to pedestrians. The safety zone thus serves to render safe a more constant and rapid movement of traffic.

There are four general types of safety zones: (1) the paint line zone, (2) the elevated platform, (3) the signalized zone, and (4) the post or stanchion zone.

The *paint line zone* is the simplest and by far the least expensive. It is arranged by enclosing a designated portion of the street surface with a painted line from 4 to 8 inches in width. The space thus marked out is reserved for the use of pedestrians and vehicles are forbidden to enter when it is so occupied. It is clear that this type of zone affords but little protection to

the walker. However, it does tend to keep pedestrians in more compact groups when they are in the roadway, and serves to mark limits beyond which drivers cannot proceed. It has the drawback which attaches to all painted signals in the roadway; the lines soon become dim from wear and lose their effectiveness, unless frequently repainted. The paint will be preserved and the protection offered will be increased if traffic buttons are placed at intervals along the lines.

The *elevated platform* type of zone is one which has gained considerable favor and is now widely used. These zones are usually constructed of concrete, as, for example, those found in Newark,

FIG. 12.—Typical platform loading zone.

N. J., though they are occasionally constructed of wood as in Washington, D. C. The platform is generally as high as the street curbings, and thus it affords a refuge for pedestrians quite as safe from vehicular interference as the sidewalk area. The end of the zones should be rounded so as to ward off vehicles which run into them. While this zone offers considerable protection it is relatively costly in construction.

The *signalized zone* is one which is created by the placing of a sign in the street indicating the nature of the area reserved. The sign frequently directs drivers to pass to the right. The

signal either is removed from the roadway at night, or is provided with a light. In some cases flashing beacons have been used to designate safety zones. For this service the heavier type of beacon is especially useful as it not only gives a clear warning and direction to traffic, but affords a physical barrier of such proportions as to protect individuals in the zone even though the signal should be disregarded by drivers.

The fourth type is the *post or stanchion zone.* This is constructed by placing along the boundaries of the reserved area,

FIG. 13.—Post type safety zone, Detroit.

standards resting on the street surface or set into the pavement. The former method has the advantage of economy and, moreover, provides a zone which can be removed for special occasions such as parades. The standards may be used singly or may be connected with chains. The use of connecting chains is a practice which is generally condemned, for it is claimed that in case a motor collides with one stanchion the others will be pulled from their bases and perhaps injure those standing in

the zone. In Baltimore, however, where this practice is followed, the writer was informed by police officials that no such difficulties had been encountered. It should be pointed out that the connection of the stanchions in some manner is desirable, for in this way a barrier is created which makes it necessary for pedestrians to enter the zones at certain points where their movement can be watched more carefully by drivers, and controlled, if necessary, by officers. The connecting chains can be used with safety if the supporting posts are set firmly into the pavement. The best example of the post and chain type of zone is to be found in Detroit, Michigan. It consists of a row of heavy, wrought-iron posts, 6 inches in diameter. The posts are set 3 feet into the pavement, 8 feet apart, and stand 3½ feet above the street surface. The loading zone thus created is 5 feet wide and 28 feet in length. To prevent motors from running through the area a post is set near the car track at both ends of the zone. An additional post, protected from collision by the first, is provided with a signal light. All of the posts are connected by a ½-inch, wrought-iron chain. The economy of this type of zone is indicated by the fact that it costs but one-fourth the sum necessary for a concrete zone of similar size.[1]

[1] For a further description of this zone and the methods of installation see *American City Magazine*, p. 451, May, 1923.

CHAPTER VII

REGULATION OF MOVING TRAFFIC

A well-designated street system, adequate in capacity, properly constructed for modern traffic, and free from hampering obstructions, is the first requirement for good circulation. But even with an ideal street plan, nothing short of complete chaos would result unless there were regulations controlling the actions of the various units of traffic. The users of city streets are controlled by two sets of rules: the statutes of the state usually collected in a State Motor Vehicle code, and the ordinances of the city council. Upon the intelligent formulation of these rules for street use and upon their proper enforcement depends to no small extent the efficient use of the traffic arteries of the city, and the safety of those who pass through them.

REGULATION OF SPEED

The problem of speed regulation is one of the most important to be considered in the framing of a vehicle code, and at the same time it is one of the most difficult. The question of speed presents a definite conflict between the interest of the individual user of the street, and the interest of the general public. From the viewpoint of the individual the most desirable speed is one which satisfies his personal needs and wishes. If the question is considered only from the standpoint of free movement it would seem proper to permit each user of the street to travel as rapidly as he desired. But there is another side to consider. Fundamentally all traffic accidents can be reduced to one cause, that is, too great speed under a given set of conditions. Theoretically, therefore, from the standpoint of safety, all vehicular traffic should be so limited that accidents would be made impossible.

The demands for perfect freedom of movement, and for perfect safety are both obviously extremes which cannot be satisfied. The freedom of the individual user must be sacrificed for the safety of the general public, and the general public, on the other hand, must sacrifice some part of its security for the

benefit which it derives from a more speedy method of transportation. The most practical speed regulation is clearly one which strikes a just balance between expedition and security. The task of the lawmaker would be greatly simplified if this balance could be determined by some mathematical process. That it cannot be is due to the fact that conditions on the street are constantly changing, and that the ability of users of the streets to avoid conflicts varies with their personal temperaments, and the qualities of the vehicles which they control.

If it could be assumed correctly that all drivers were persons of perfect judgment the best type of regulation would be one which placed no definite limitation upon speed, but which permitted the driver to move at any rate consistent with the safety of the life and limb of other users of the thoroughfare. Such an assumption, however, cannot be made. Discretion without limitation would make it possible, it is true, for each driver to proceed with the greatest possible expedition to his destination, but the quality of the discretion would be such that the practice would result in serious hazards for other street users.

There is another serious objection to the type of speed regulation which places no definite limitation but which merely requires *reasonable and proper* operation. Judge F. B. House of the New York Traffic Court says:[1]

> In each court case at least two questions of fact arise—the rate of speed and reckless driving. The latter question involves many others. How many vehicles were on the street, how many pedestrians, their relative positions, and how fast was the vehicle moving? How wide was the street and what signals were given? Did the act charged as reckless cause an accident or not, and if not, was it reckless? The testimony of a single officer many times can be offset by the testimony of several occupants of the car. Street cars, trucks, carriages, tradesmen's delivery wagons, automobiles and pedestrians, including many women, children, the infirm and aged, are constantly mingling from four different directions at intersecting streets. The unexpected is always happening. Under such conditions an automobile should be under perfect control, and at least as much control as a horse and carriage. *The maximum speed limit should mean perfect control beyond which there is no discretion.*
>
> The rule of discretion makes a policeman a judicial officer. Arrests should always be made with discretion, but upon definite and specified principles which should be established by law so far as possible. Too

[1] *First Annual Report of the Traffic Court*, p. 13.

many men should not be vested with judicial power. In some instances it has been urged that the proposed limitations of speed will be a hardship for drivers of discretion. The answer is that drivers of discretion are not exceeding the limitations prescribed in the proposed ordinance under various conditions.

The impossibility of trusting individuals to use proper discretion combined with the difficulty of enforcing the "reasonable and proper provision" makes it appear necessary that the vehicle code should indicate definite speeds which cannot be exceeded, without incurring penalties. Whether these regulations will serve as an unnecessary burden to the users of the street will depend in each case upon the accuracy with which the lawmakers determine the rate of speed consistent with safety under varying conditions. All drivers of motor vehicles are familiar with the small town which enforces an absurdly low limit, not at all because it is required for safety but simply for the purpose of collecting fines.

The most generally adopted method for formulating speed regulation has been to differentiate rates for specified zones within the city, and in addition special regulations for various localities such as railroad crossings, schools, and parks. Examples of this type of regulation are indicated in the following chart on p. 89, and the attention of the reader is called to the varation among the different cities.

It will be noted that the rates permitted in the congested districts range from 8 miles per hour in St. Louis to 20 miles per hour in Buffalo, and that the two cities likewise illustrate the extremes in the secondary or residential district, providing for 10 miles per hour and 25 miles per hour, respectively. Criticism of the limits provided by different communities is difficult to make for conditions vary, but observation in the above cities leads to the opinion that a limit of less than 15 miles an hour in the business district and 20 miles per hour in the outlying districts is neither useful nor enforceable.[1]

[1] Mix, Judge George E., Municipal Court of St. Louis. "Law Enforcement and Its Application." *Proceedings*, National Safety Council, p. 337, Chicago, 1920.

"As a practical automobilist, when I went to the bench 1½ or 2 years ago, I recognized that 10 miles was unfair to the automobilist. I recognized that 10 miles an hour stripped the automobile of all of its efficiency. You might better return to the horse-drawn vehicle days and do away with all the hazard and all the danger than to try and drive automobiles or have

SPEED LIMITS IN TYPICAL CITIES

City	Business district	Residence district	Open country or blvd.	Crossings	Schools
Baltimore	12	18	25		
Buffalo	20	25	..	15	
Cleveland	15	20	..	..	10
Detroit	10	15	..	½ legal	
District of Columbia	18	18	..	12	
Kansas City	15	25	..	10	
New Orleans	15	20	25–30	8	
Newark	12	..	..	6	6
Portland, Ore	15	20	..	½ legal	10
St. Louis	8	10	..	6	
Seattle	20	20	..	12	12
Code of Motor Vehicle Conference Committee	15	20	30		
California Motor Vehicle Act	15	20	35	15	15

These limits, however, should never be interpreted as meaning that drivers have the right in the respective districts to travel at the maximum speed when conditions on the streets make such a rate of speed dangerous. The specified rate of speed is merely a limitation and does not confer a right. This situation is made clear in the traffic code of the city of Cleveland which reads as follows:

No person shall operate . . . a motor vehicle or motor cycle on the public roads, streets, or highways of said city, at a rate of speed greater than is reasonable and proper, having regard for the width, traffic, use, and general and usual rules of such, roads . . . A rate of speed greater than 15 miles per hour in the business or congested district . . . or more than 20 miles per hour in other portions thereof, shall be pre-

automobile trucks driven for you at no greater rate of speed than 10 miles an hour. Judge Ittner and I went to Chief O'Brien, our Chief of Police, and we arranged with him, cooperating with him through the traffic officers and motor cycle officers, to permit automobilists in St. Louis to travel 25 miles an hour without being arrested for speeding."

sumptive evidence of a rate of speed greater than is reasonable and proper."[1]

The simple but effective provisions of the Massachusetts state code are similar but there are some additional details.

No person operating a motor vehicle on any way shall run it at a rate of speed greater than is reasonable and proper, having regard to traffic and the use of the way and the safety of the public. It shall be *prima facie* evidence of a rate of speed greater than is reasonable and proper as aforesaid if a motor vehicle is operated on any way outside of a thickly settled or business district at a rate of speed exceeding 20 miles per hour for a distance of ¼ of a mile, or inside a thickly settled or business district at a rate of speed exceeding 15 miles per hour for a distance of ⅛ of a mile, or in any place where the operator's or chauffeur's view of the road traffic is obstructed either upon approaching an intersecting way, or in traversing a crossing or intersection of ways, or in going around a corner or a curve in a way, at a rate of speed exceeding 8 miles per hour.[2]

The use of the *boulevard stop* or *arterial highway* regulation is now becoming quite general in American cities. These protected thoroughfares have proved their ability to pass traffic safely at a relatively high speed. In formulating speed regulations it would appear reasonable to permit traffic upon such protected streets to move more rapidly than upon ordinary thoroughfares. A movement is at present on foot in California to raise the maximum speed limit on boulevard stop streets 5 miles per hour above the existing maximum of the various districts.

In addition to rates of speed based on districts, it seems reasonable that there should be some additional classification for various types of vehicles. Large, heavily laden, commercial vehicles cannot be controlled with the same facility as lighter pleasure vehicles. Moreover, they become very destructive to road surfaces when they travel rapidly, and this affords an additional basis for their speed restriction.

The present California state code takes both the hazard and destructive element into consideration in the following provisions:[3]

[1] *Traffic Code of the City of Cleveland*, sec. 2271, Cleveland, 1922.

[2] *Legislative Rules and Regulations relating to Motor Vehicles*, sec. 17, Boston, 1922.

[3] *Motor Vehicle Act of* 1923, sec. 118, part *b*.

When gross weight of load is:	Maximum speed in miles per hour
9,000 pounds or more but not more than 12,000 pounds	25
Over 12,000 pounds but not over 22,000 thousand pounds	15
Over 22,000 pounds	10
When a truck or trailer is constructed or otherwise adapted for carrying loads weighing 4 tons or more, exclusive of the weight of such vehicle, when and whether such vehicle is laden or unladen	15
When a truck or trailer is equipped with tires wholly or partly metal	6

With the growth of motor traffic and congestion the question of a minimum speed rate as well as a maximum deserves consideration. Analogy can be found in various municipal ordinances which forbid the loitering of individuals in the public streets. The loitering vehicle is a serious problem in heavy-traveled thoroughfares, for it retards the movement of other vehicles. Already the police officers in a number of cities are urging cars to move at a more rapid pace, but in no place have they been given authority by ordinance to require a definite speed. It is suggested that for major streets, when the conditions of traffic permit, all vehicles should be required to move at not less than one-half of the legal maximum of the district.

Should the state motor vehicle act prescribe uniform speed laws for all municipalities within the state or should each community be permitted to make its own regulations? There are a number of reasons for favoring the former plan. Interurban motor traffic has become increasingly common. Much confusion is caused where the speed regulations of each city vary. A state law covering all communities makes it possible for a driver from any part of the state to know precisely what is required of him. Another reason is to be found in the practice already mentioned where small communities establish unreasonably low speed limits, and enforce them rigidly for the sake of the fines which they are able to collect. A uniform speed law established for the various zones—open country, suburban sections, and business or congested districts—makes it impossible for municipal

corporations to act unreasonably toward motorists from other parts of the state.[1]

There are, however, certain objections against such a uniform provision which deserves attention. Communities vary greatly in the conditions of their streets and roads. What may be safe speed in one may be hazardous in another. If the speed rate indicated by the state act is so low as to make travel safe under the most dangerous conditions it will either not be enforced under safer conditions, or if enforced will serve as a hardship. This argument is largely counterbalanced if the state law in addition to the specification of a high maximum limit, includes as well a prohibition of driving at any rate of speed which is not reasonable and proper and which creates a hazard to other users of the way. In this manner there can be obtained the advantages of a uniform maximum rate in all of the communities of the state, and at the same time no city or town will be under necessity to tolerate reckless driving within its limits.

Enforcing Speed Regulations.—There is probably no part of the vehicle code which is more difficult to enforce than the regulations regarding speeding. The offense is committed at a time when the offender is moving rapidly, which fact makes it difficult to ascertain definitely the degree of the violation, and renders apprehension difficult under any conditions, and dangerous if the offender is malicious.

Numerous methods for apprehending speeders have been used. The bicycle and mounted police did fair work in the early days in catching the "scorcher," but the increase in motor speed soon rendered these methods useless. Motor cycle police are undoubtedly the most effective at the present time, though these too have their limitations. The presence of the officer is usually made obvious by the sound of his motor and the speeder slows up until he is sure that the representative of the law is no longer on his trail, and then resumes his former speed. The motor cycle has the advantage of speed over the four-wheeled vehicle, but when it carries a single officer his testimony must often be weighed against that of several occupants of the motor car. The use of the tandem partially eliminates this disadvantage, but it decreases the flexibility of operation, and at high

[1] The Committee on Traffic Control, appointed by the Secretary of Commerce, *Report*, p. 13, recommends a basic control of speed through uniform state laws which lay emphasis on reckless driving.

speed increases the danger to the riders. The motor cycle has the disadvantage of being practically useless under conditions of snow or dampness or on streets where there is heavy dust. Considering these conditions a number of cities have adopted motor cycles with side car equipment carrying two officers, and still having adequate speed under all weather conditions. Others are using, to some extent, light but fast four-wheeled motor cars.

The so-called "speed trap" is a method which has long been used for the discovery and apprehension of violators. A speed trap may be defined as a particular section of the highway which has been measured and upon which the officer determines the speed of vehicles by noting the elapsed time during which a vehicle travels from one end of the trap to the other. This method affords the most accurate means of determining the rate of speed. The speed trap is a source of annoyance to those who have not been too careful in obeying the law. The prejudice against this method of apprehension has become so strong that in one state the use of testimony gained by means of a speed trap is barred from admission in the courts, and the law requires that the officer must be in plain sight on the highway in making arrests for speed violation.[1]

The installation of raised or depressed obstacles in the street surface has been advocated and used in some places for the control of speed. Both of these constructions have the same purpose. They are so made that it is possible for vehicles to pass over them at low speed, with but a slight jar, but the amount of rebound increases with the speed of the vehicle. The value of the device is doubtful from the standpoint of safety which is, after all, the chief reason for all speed control. An unsignalized obstacle in the street which may result in injuries to the occupants of cars, and to the machine itself may create a greater hazard than that brought about by too great speed. If the "speed checkers," are located at a place where high speed is considered especially

[1] *California Motor Vehicle Act of* 1923, sec. 155, "Evidence based on use of speed traps not to be admitted . . . Nor shall any testimony in any such case be admitted in any court from any officer or officers arresting or participating or assisting in the arrest of such person in which any speed trap was used in such arrest, or if such officer or officers or any of them, were not at the time of such arrest dressed in a distinctive uniform and patroling or upon the highway upon which the arrest was made, in plain sight of all persons traveling thereon."

dangerous, as at intersections, they may create a serious hazard by throwing out of control the vehicles which pass too rapidly over them. Another disadvantage lies in the fact that no obstacle of such a nature has been devised which will have the same effect upon all types of vehicles. Where they have been used the opposition of motorists has usually been sufficient to bring about their elimination. A final disadvantage is identical to that noted in connection with depressed drains at street intersections: motorists will avoid streets on which they are used.

The speed governor for each vehicle is another control scheme which has gained some support. Those who advocate it, advance the argument that no driver of an automobile has a right to demand that he be able to operate his machine at a rate of speed greater than that set as a maximum by the law, and that, therefore, there should be no objection to placing on every machine a governor which would make a higher rate of speed impossible. The writer has been informed by manufacturers of motor vehicles that such a speed governor is entirely practicable from the standpoint of mechanical operation, and indeed is at present used as regular equipment on certain types of commercial vehicles. Should the state law require such a device for all motor vehicles, it could demand, as it often does at present for headlights, a certificate from a regular inspector that the device was in proper working order. That the use of governors would eliminate much of the present-day speeding is not to be doubted. The plan, however, would undoubtedly meet with serious opposition from motorists, and they would have a certain amount of reason for their objections. In addition, even the most perfect device would be subject to change and readjustment for higher speeds by those who were determined to break the law. Perhaps the chief argument against the governor lies in the fact that it can do no more than control the maximum speed, and that frequently the most hazardous speed is one much less than that set by the law. There are no statistics available for accurate conclusions, but it is the opinion of the writer that a large percentage of the fatal vehicle accidents occur where the speed is materially less than the maximum indicated in the law.

Regulations for the Classification and Segregation of Moving Vehicles.—From the standpoint of rapid and safe traffic movement there is no more important type of municipal regulation than that which looks toward a segregation of the various types

of traffic units according to their capacity for speed and flexibility of movement. Undoubtedly the most desirable segregation is that which is brought about when there is a complete physical separation of the fast and the slow vehicles by the use of some such plan as the two-level or two-part street, but much can be done in this way by proper regulation.

The retarding effect which slow-moving vehicles have on faster units is well expressed by a writer on traffic subjects: "The movement of vehicles is no faster than the slowest in the line ahead unless the cars behind thread in and out to get ahead. This is a dangerous practice and is to be discouraged,"[1] and moreover, it may be added it is a practice which is quite impossible where traffic is dense.

The admixture of fast and slow traffic does not mean that the traffic stream can move at a speed which is the average of the capacity of all the vehicles in the line, but that it is controlled by the slowest. It is clear therefore that any regulation that can bring about a segregation of the slow vehicles and the faster ones, will not in any manner lessen the speed of the slower traffic, but will bring about a much greater potential speed for units of traffiic which have a greater speed capacity.

This very desirable segregation can be accomplished in one of two ways: (1) by requiring that vehicles of certain types keep to certain parts of the street surface; (2) by denying to slow vehicles the right to use specified streets.

The first type of regulation is to be found in the traffic ordinances of practically all cities and is usually expressed in some such form as follows:

> Slow-moving and heavily laden vehicles shall keep as near to the right curb as possible so as to allow free passage for faster-moving vehicles.[2]

Other ordinances add the further provision that:

> Slowly-moving or heavily laden vehicles shall not be driven upon the streets abreast, but one must follow behind the other and keep as near the right-hand curb as possible.[3]

[1] KELCEY, GEORGE G., "American Gas Accumulator Company," Elizabeth, N. J.

[2] *Traffic Laws, City of Newark, N. J.*, sec., T. A. 4–(14).

[3] *Ordinances Governing Street Traffic*, City of New Orleans, art. 2, sec. 6, New Orleans, 1923.

Others make the general provision that:

A vehicle shall keep as near as practicable to the right-hand curb so as to leave the center of the street clear for overtaking traffic—*the slower the speed the nearer the curb.*[1]

This type of regulation which attempts a segregation of vehicles on the surface of a street is desirable, but in no place is it enforced rigidly, and it is to be doubted if it can be. It does not go far enough, for even though enforcement could be had there would still be a large amount of unavoidable intermingling of the various types. More benefit is to be expected from the regulation which prohibits the use of certain thoroughfares by specified classes of vehicles, and thus sets aside certain streets for the use of the fast and the slow traffic streams.

This regulation appears rather drastic at first glance, but it is merely the prototype of the park and boulevard ordinances which have been in use for a long time. For example, the St. Louis ordinance provides that:

No omnibus or express wagon, nor any cart, dray, truck, or other vehicle carrying goods or articles of any kind . . . shall be permitted to use the drives of the public parks.[2]

The ordinances of the City of San Francisco provide that:

Freight wagons carrying certain types of material, of certain means of propulsion, and of specified weights shall not use designated streets in the congested district between the hours of 8 a. m. and 7 p. m.[3]

The question arises as to how this classification of vehicles should be made, and under what conditions it is necessary. The recommendations of the National Highway Traffic Association afford an answer.[4] They are in brief:

1. Exclusion of a class of vehicular traffic from a thoroughfare which is for the purpose of expediting traffic and not for the purpose of what might be called "park traffic" reasons, should be on the basis of speed

[1] *Regulations for Street Traffic*, art. 1, sec. 6, New York City, 1919.

[2] *St. Louis Traffic Laws and Regulations*, sec. 1878, R. C., 1921.

[3] *Traffic Laws Governing the Operation of Motor Vehicles in San Francisco*, sec. 30.

[4] *Municipal Journal*, vol. 46, p. 72, 1919.

rather than that of the load carried. Solid and pneumatic tires afford a fair test of speed ability.

2. Fast-moving traffic, if separated from slow-moving traffic on the same street by the ordinary methods of regulation, causes little or no delay to the traffic of a street of large capacity and ought not therefore be excluded from any street where the traffic of heavy, slow-moving vehicles is not so large as to tax the capacity of that street under proper regulation.

3. The restriction of a series of continuous streets to one class of traffic results in wide diversions of the prohibited class in reaching a thoroughfare where it is permitted, therefore alternative streets, where possible, should be used for the different classes.

4. The operation of any restrictive regulations should be limited to the period of the day when traffic is heavy.

The effectiveness of usual segregation regulations is somewhat impaired because of permission extended to vehicles of the slower class to enter the fast street for the purposes of actually delivering goods.

This brings up the question of methods of enforcement. In case the regulation simply calls for the use of various parts of the same street by different classes of vehicles, the segregation can best be enforced by the use of paint lines on the street surface. The enforcement method for segregation according to streets, devised by the technical experts of the Chicago Plan Commission, deserves attention. The proposal provides a comprehensive street plan for the entire city that will segregate various kinds of vehicles, and indicates certain streets for the use of specified varieties of traffic.

One class of streets will be restricted to light, fast-moving vehicles, and another to slow, heavy-laden vehicles. Eventually the widths of the streets and the types of paving will be designed on the various streets according to the character of the traffic which they carry.

For enforcement an ingenious color scheme has been proposed. Signs of a certain color will be erected at street intersections indicating the class of traffic permitted. Vehicles of various classes will be required to carry plates similar in color to the signs erected on the streets in which they are permitted to travel. By this means drivers will be able to tell easily whether they may travel on a given street, and police officers can ascertain at a glance when vehicles are on the wrong street. It is claimed that

the plan will not only result in the speedier movement of all traffic but that material saving will be brought about by the use of lighter pavements on the light-vehicle streets.[1]

Along with the regulation which results in the segregation of traffic, passing attention should be given to the proposal for the limited use by certain classes of traffic of specified portions of the city. This proposal takes two forms; either a complete prohibition during certain hours for some types of vehicles, or admission only upon the payment of a special fee.

The former suggestion has been advanced especially in connection with horse-drawn vehicles, and appears to have considerable reason. So few persons in the community would be inconvenienced, and to so small an extent, considering the ease with which services can be motorized today, that there appears to be no practical reason why horse-drawn carriages and trucks should not be entirely prohibited from congested parts of the city.[2]

The second proposal for limited use suggests that vehicles be admitted to certain parts of the city only if they can show that

[1] The right of municipal corporations to make such regulations segregating traffic, and to restrict the use of specified streets or portions of streets to designated classes of vehicles appears to be well established. The rule must, of course, conform to the general requirements of other police regulations.

Thus a municipal corporation can, subject to the rights of owners of abutting property, exclude business traffic from a public street and direct that it be used for pleasure purposes only. 3 *Dillon*, 1852. And it has been decided that a statute changing a public street into a pleasure drive does not, in any way deprive a citizen of his property without due process of law, or take or damage his property for public use without just compensation. *Cicero Lumber Co. v. Cicero*, 175 Ill., 9. It would seem reasonable to suppose that a street might be made a business street and all pleasure vehicles excluded.

Dangerous vehicles may be excluded from certain districts when the public safety requires. *State v. Mayor*, 106 Me. 62, and *Commonwealth v. Kingsbury*, 199 Mass., 542.

A statute may require slow-moving vehicles to keep to the right side of the street at points where traffic is heavy or the streets are unusually congested, and it is no defence that at the time of its violation the defendant was not in fact blocking the traffic. *State v. Bussian*, 111 Minn., 488.

A municipality may refuse to grant permits for the operation of jitney busses, or restrict their use to certain designated streets. *McGlothern v. City of Seattle*, 199 Pac., 457.

[2] An ordinance recently adopted in the city of Los Angeles prohibits animal-drawn vehicles from entering the central traffic district between the hours of 4:30 and 6:00 p. m.

they have some actual business there, and if they have obtained a special license which permits them to enter. This suggestion is so novel that it will undoubtedly be slow in gaining support, yet it has some points in its favor. Practically every American city shows a condition of almost complete street saturation from the mid-morning hours until the out-town rush in the evening. The streets are filled with two classes of vehicles, essential and non-essential. Many of the private passenger automobiles on

FIG. 14.—The retarding effect of horse-drawn vehicles as illustrated in Philadelphia.

the streets are there merely because their owners demand a portion of valuable street area for the transportation of themselves. Others have no business to transact in the business section but have a destination beyond and are passing through merely because of habit, or because they enjoy "shooting the traffic." The amount of non-essential traffic on the busy streets of a city is much greater than is usually estimated. The street commissioners in Boston, after a thoroughgoing survey, came to the conclusion that not more than 23 per cent of the vehicles on

Tremont Street, the main shopping thoroughfare of the city, had any real business to transact there, but were passing through or back and forth merely because "the drivers like to view the passing show and to be in the midst of congested traffic . . ." How far it would be possible to eliminate all or a portion of this non-essential traffic by a method of special licenses is difficult to say. The control of unnecessary street traffic should make some provision for the regulation of the "cruising taxi," a type of traffic which in some of the larger cities has come to be a serious nuisance. A more rigid license law if properly applied, is effective in keeping the supply of cabs somewhere near the number actually required by the public. The practice of some cities in setting aside definite portions of the street surface for "hack stands" makes cruising less necessary. In addition, local ordinances should restrict the activites of cabs when not actually engaged in carrying passengers. The traffic ordinance of the City of Baltimore provides that:[1]

> No public or private hack, while waiting employment by passengers, shall stand in or upon any public street or place other than at or upon public or private hack stands, respectively designated by the Board of Police Commissioners; nor shall any hackman seek employment by repeatedly and persistently driving his hack to and fro in a short space before or by otherwise interfering with proper and orderly access to, or egress from, any theater, hall, hotel, public resort, railway or ferry station, or other place of public gathering . . .

Similar to the cruising taxi in its effect upon traffic is the advertising vehicle. Since its business in the street is not for the purpose of actual transportation, but merely for publicity purposes, there seems to be good reason in regulations which prohibit its use in congested districts. Vehicles used entirely for purposes of advertising are not only a class of traffic which is non-essential, but the movement of such vehicles at a slow rate of speed offers undue obstruction to more important elements of the traffic stream. St. Louis has restricted the use of advertising vehicles by the following provisions:[2]

> Vehicles for display advertising or public inspection shall not stop within the congested district except on direction of traffic officer or on approach of fire apparatus, and shall move at not less than 3 miles an hour.

[1] *Traffic Regulations*, art. 3, sec. 6, 4th. ed., Baltimore, 1917.

[2] *St. Louis Traffic Laws and Regulations*, sec. 1330, R. C., 1914, 1921.

The City of Cleveland goes further and makes the very desirable and reasonable provision that:[1]

> The driving of vehicles to and fro upon the public highways within the city for the sole purpose of advertising is hereby declared to be a nuisance and unlawful.

The use of the motor vehicle as a common carrier has created many problems of regulation, both in connection with density of traffic and the safety of passengers and other users of the streets. Where the jitney is unregulated, it tends to monopolize the streets and naturally selects for its operation the busiest streets where the obstruction to traffic is most serious. The motor bus of large capacity appears to have gained for itself a definite place in the municipal transportation system as is indicated by its use in New York, Baltimore, Washington, Detroit, Chicago, St. Louis, and Los Angeles. Its merits as a traffic instrument need not be considered here except to note that it clearly makes a more efficient use of the street surface than does the private passenger automobile, and that in this respect it is a close rival of the street car.

The larger American cities have made provision for the control of this type of transportation. They include regulations regarding drivers, method of operation, fares, routes, and bonding. From a consideration of freedom and safety of traffic movement municipal ordinances should undertake to provide the following:

1. Safe construction and proper equipment.
2. Special licenses for drivers following a demonstration of ability.
3. Limitation of numbers to those actually required by the public.
4. The control of routes so that undue obstruction will not result in the busy streets of the city.

One-way Streets.—The use of one-way streets or thoroughfares is of great antiquity, there being some indication that the regulation was used in Pompeii, where the narrow lanes allowed the passage of but one line of vehicles. In modern cities it is of rather recent use. A one-way street may be simply defined as a street upon which traffic is permitted to move in but one direction.

[1] *Traffic Code of the City of Cleveland*, sec. 2251*a*, 1922.

The popularity of the one-way street plan is indicated by the fact that thirteen of the largest cities of the country have made definite provisions for this type of traffic. Critical observation of the functioning of one-way traffic in these cities makes possible the deduction of certain principles which may properly govern the installation of one-way traffic thoroughfares.

What advantage has a one-way street over a two-way street for traffic movement? The answer is simple, for while the one-way movement does not in any manner increase the physical area available for vehicular movement, it does tend to increase the per hour capacity of the street, by reducing the potential conflicts. Weaving in and out is facilitated when all vehicles enter and move in the same direction. The drivers have only the vehicles ahead of them to avoid and are not under the necessity for paying attention to on-coming vehicles. The intersection problem is likewise simplified, for the number of potential left and right turns is reduced by 50 per cent. The element of greater safety to pedestrians is one which should be considered also, for they need observe approaching traffic from but one direction.

What streets may with profit be made one-way thoroughfares? There are two types of streets which seem desirable for this type of regulation. One is the relatively narrow thoroughfare on which there is a one-way car line. On this kind of street vehicular traffic is required to move in the direction of the rail cars. Philadelphia which was one of the first and most successful users of one-way streets provides that:[1]

> All streets over which a single line of street railway cars is operated shall be one-way streets, and all vehicular traffic upon every such street shall be in the direction in which the street car line is thereon operated.

Other streets which it seems desirable to make oneway thoroughfares are those in which the roadway is 20 feet or less in width, thus providing for no more than two lanes of traffic. In Cleveland:

> The Director of Public Safety may designate . . . one way traffic streets in the congested district, in cases where the roadway is less than 15 feet in width.[2]

[1] *Traffic Ordinance City of Philadelphia*, sec. 1, 1923.
[2] *Traffic Code of the City of Cleveland*, sec. 2263, 1922.

Because of their usual narrow width and because of the class of vehicles which usually frequent them, alleys are especially good subjects for one-way regulation. A general provision covering all alleys in a congested district may with reason be made, as has been done in St. Louis where the regulations require that:[1]

> In all east and west alleys, vehicular traffic shall move west; and in all north and south alleys it shall move south.

Los Angeles and Kansas City also establish similar one-way regulations for alleys in the congested district.

There are a number of considerations which should be borne in mind when one-way traffic regulations are contemplated. A traffic street in one direction should always be balanced by one in the other direction, and preferably by the next parallel thoroughfare. Otherwise a series of parallel streets all flowing in the same direction will unbalance the street system and will make necessary an undue diversion of vehicles, the drivers of which wish to go in a direction opposite to that in which traffic is permitted. Care must also be taken in making one-way regulations for important business thoroughfares, lest concerns located upon them be unreasonably injured by a diversion of their customers. A proposal in Boston to make Tremont Street one-way south, met with the unanimous protest of merchants located on the thoroughfare, and they were able to show that the regulation would tend to divert much of their valuable patronage which approaches their places of business from a southerly direction.

Cities have given some consideration to the question of creating one-way streets which shall flow toward the business district during the morning in-town rush and outward in the afternoon during the out-town rush. There is much merit in the idea as can be seen by the observation of any major artery during either one of these peak periods. Cleveland has adopted this plan in a modified form for the High-Level bridge, where it is provided that during the morning and evening rush hours inbound and outbound traffic, respectively, may encroach a specified distance upon the left-hand side of the bridge roadway.

Every one-way street should be conspicuously marked at each intersection with a sign showing the direction in which traffic is permitted. In Boston arrows pointing in the designated direc-

[1] *St. Louis Traffic Laws and Regulations*, p. 14, 1921.

tion are used. In other cities the method of placing a flashing beacon or other signal or a printed sign in that part of the roadway which would normally be used by a vehicle entering in the wrong direction, has been used with considerable success.

In order that one-way streets may be most effective a special type of parking regulation is necessary upon them. The rule established in St. Louis works satisfactorily:

> All vehicles will move in the direction of traffic in the center or on the left-hand side of the street, and all parked vehicles shall be upon the right-hand side of the street at either angle or parallel as the width of the street may demand.[1]

Regulation of Vehicles in Overtaking.—In order that traffic may be as flexible as possible, and in order that faster units may not be unduly retarded by slower units in the roadway ahead of them, every reasonable provision should be made for the easy and safe passing of vehicles traveling in the same direction. The general rule in this country is that the overtaking vehicle shall pass to the left, with the general exception that street cars shall be passed to the right. It is possible that this regulation is now so deeply imbedded in the driving habits of the American public that a change in the rule would be neither possible nor desirable. It should be pointed out, however, that the rule works for traffic delays and hazards in a number of ways. The tendency of all drivers, notwithstanding regulations to the contrary, is to keep fairly close to the center of the roadway, no matter what their speed of travel. A line of traffic both fast and slow is to be found in the center of the roadway, and except in conditions of dense traffic, or when vehicles are forced there by passing cars, the sides are relatively little used.

Drivers who desire to pass slow vehicles ahead of them are forced by the present rule of the road to go around to the left, which means that they must usually encroach on the left-hand side of the roadway in the path of the on-coming traffic. Such maneuvering is made difficult in dense traffic for the on-coming vehicles likewise tend to cling to the center of the roadway. The driver must therefore be satisfied to have his speed controlled by the slow-moving traffic in his own line ahead, or bide his chance to speed around to the left when there is a momentary break in the on-coming line. This practice creates great hazards

[1] *St. Louis Traffic Laws and Regulations*, p. 13, 1921.

for it necessitates the close passing of vehicles traveling in opposite directions, under conditions when at least one of them is on the wrong side of the roadway, and traveling at accelerated speed. This weaving in and out is one of the fertile causes of head-on collisions, and of side-swiping, resulting from "cutting-in."

If the present rule were changed so that all overtaking vehicles were required to pass to the right, as is always done in overtaking street cars, traffic would be expedited, and hazards would be reduced. Under such a regulation the slow-moving vehicles would keep to the center of the roadway as they do at present, and thus all vehicles passing in opposite directions would do so at a relatively low speed. The faster-moving vehicles would pass to the right, using that portion of the roadway which is comparatively clear. Moreover, since there would be traffic on but one side of them, the drivers would be in no danger of being squeezed or "boxed" between two lines of moving traffic.

But no matter which rule is adopted, either the left- or the right-hand regulation should be definitely specified and enforced. In a number of cities the police permit overtaking drivers to use their discretion as to whether they shall pass on one side or the other. Such a practice throws an element of chance and danger into passing which may readily result seriously if the driver ahead mistakes the intentions of the overtaking driver.

The provision contained in the Detroit regulations requiring that "No persons, operating a motor vehicle, shall pass two moving vehicles moving in the same direction which are abreast or so nearly abreast as to occupy the width of two vehicles of a city street,"[1] is a desirable requirement where no more than two lanes of vehicles can be accommodated on the street without encroachment on the left side of the roadway. But it would obviously work for an unnecessary restriction of movement on wider streets where three lines of vehicles may move in each direction with safety.

In order to facilitate overtaking, and to make the process safer, there should be definitely understood signals. The Portland, Ore., ordinance requires that, "A motor vehicle overtaking any other vehicle, before passing shall give one blast of horn or bell."[2] The vehicle overtaken should likewise be

[1] *Detroit Street Traffic Ordinance*, part 2, sec. 8, 2nd. ed., 1920.

[2] *Digest of Traffic Ordinance*, p. 5, 1921.

charged with the duty of giving way to the driver desiring to pass. The practice of some drivers of speeding up their machines immediately they become aware of the desire of someone to pass, not only adds to the difficulty of passing but likewise increases the hazard. In no place is the proper duty of a driver who is being overtaken more clearly and reasonably set forth than in the California Motor Vehicle Act of 1923 which provides that:

> The drivers of vehicles upon a public highway about to be overtaken and passed by another vehicle proceeding at a lawful rate of speed shall give way to the right in favor of the overtaking vehicle on suitable and audible signal being given by the overtaking vehicle, *and shall not increase the speed of their vehicle until completely passed by the overtaking vehicle.*[1]

Regulation of Street Cars as Units in the Traffic Stream.— There is no doubt, from the standpoint of both safety and freedom of traffic movement, that the best solution of the struggle between the street car and the automobile is the complete removal of the former carrier from the street surface. The provision of more adequate rapid transit facilities, either elevated or subway, is a problem which is at present facing a number of large cities. It is proper to say that were it not for the fact that the chief rail facilities in the central part of Boston are underground the traffic congestion on the street surface would long since have reached a point where business activities would have been seriously hampered. One can scarcely visualize the situation which would exist in New York City were it necessary for the day-time population of lower Manhattan to go to and from their work on surface cars. Philadelphia is planning a removal of surface cars through an extension of her subway and elevated system; Detroit is contemplating rapid transit as a means of street traffic relief; Chicago has just completed an admirable study of her rapid transit problem under the supervision of Major R. F. Kelker Jr.; and Los Angeles has come to the point where it realizes that the removal of the surface car from the congested area is the next inevitable step in dealing with the problem of street congestion.

Ultimate solutions are well to bear in mind and adequate plans should be made for them, but the fact still remains that in most American cities the major portion of the rail traffic is carried

[1] Sec. 126.

on the street surface. The immediate question is, What can be done to regulate the relation of rail and free wheel vehicles in such a manner that conflicts between them will be reduced, and that both can move with greater safety and expedition?

Perhaps the best way to approach the matter is to consider the functions performed by the two types of carriers. The average private motor carries few passengers, and uses the street surface in a relatively inefficient manner. The street car affords a means of transportation to great masses of the population who have no alternative method of reaching their destination. These elements considered in connection with the fact that the street car, because of its necessity to keep to one definite line in the street, runs under a handicap, would seem to result in the conclusion that wherever possible the free wheel vehicle should be required to give a reasonable amount of right-of-way to the larger carrier. This does not in any way mean, however, that the rail vehicles should not be required to operate in a manner which will result in the least possible delay to traffiic in general.

Most American cities have framed their regulations on the theory that the street cars were carrying on a more important business in the street than the motor vehicles, and have attempted to protect them from unnecessary delay. These regulations have been expressed in a number of different ways. One of the most general and reasonable requires that, "street cars shall have the right of way between cross streets over all other vehicles."[1]

The fact that the motor vehicle is a flexible traffic unit and can with equal ease use any portion of the roadway, makes reasonable and desirable, what may generally be classed as "anti-dragging" rules. That is to say, a regulation which makes it illegal for the driver of a vehicle to use the street car tracks for slow driving when a street car desires to pass. Drivers of horse-drawn trucks are particular offenders in this way. The San Francisco ordinance provides that:

> It shall be unlawful for any person wilfully to . . . drive or propel . . . any vehicle along or across any street railway or interurban railway track in such a manner as unnecessarily hinder, delay, or obstruct the movement of any car traveling upon such track . . .[2]

[1] *Traffic Ordinances of the City of Buffalo*, sec. 18, part 2, 1923.

[2] *Traffic Law Governing the Operation of Motor Vehicles*, sec. 54, San Francisco, 1923.

The question as to whether vehicles should be allowed to pass street cars while the latter are loading or unloading is one which has a bearing on both the safety and expedition of traffic movement. From the standpoint of safety it would appear at first glance that passing should be definitely prohibited under all conditions. Theoretically the prohibition does afford this protection, but in actual practice it probably works for increased hazard. The driver who is following a street car and knows that he is not allowed to pass it after it has come to a stop is inclined to make special haste to pass the car before it comes to a standstill. Thus in every city where motors are prohibited from passing a standing car one sees drivers attempting to rush past the trolleys at an accelerated speed immediately the latter show signs of slowing speed for a stop. If the driver can get past the front door of the car before it has reached a dead stop he is technically safe so far as the law is concerned, but the practice works for the danger of those who are standing in the street waiting to board the car.

On the other hand, if drivers are permitted to pass standing trolleys at will, and without any restrictions, too little protection is offered to those boarding and leaving the car. Somewhere between these two practices there should be a suitable compromise which will not only work for reasonably safety but which will at the same time not unduly delay vehicles. Where there are safety zones of adequate size vehicles should never be prohibited from passing at reasonable rate of speed, and those standing in the zone should be required to obey the directions of the traffic officer where one is stationed, and to wait for a traffic change. And even where there are no zones established, it is not believed that the passing of vehicles creates a serious hazard if their speed be carefully regulated. Permission to pass, where it is used, tends to reduce the practice of drivers to rush past street cars when the latter are reducing speed for a stop, and creates less danger than does the undue haste. The regulations of cities regarding passing standing trolleys, and conditions under which it may be done, vary greatly as is indicated in the following table.

The Chairman of the Chicago Committee on Local Transportation (New Jersey State League of Municipalities, *Special Report* 99, p. 1) states that in Chicago 13,000 passenger hours are lost daily because of the obstruction of street cars by automobiles.

REGULATION OF VEHICLES AND STANDING TROLLEYS IN TYPICAL CITIES

City	Must stop to rear of car	May pass if clear	Speed in passing
Baltimore	3 feet	No	
Buffalo	7 feet	No	
Chicago	10 feet	No	
Cleveland	Stop behind	At stanchion zones and if 6 feet clear in congested district	
Detroit	6 feet	No	
District of Columbia	15 feet	No passing except at safety zones	
Kansas City	5 feet	But may pass at safety zones or when 8 feet clear	10 miles per hour
Los Angeles	To rear of nearest door	But may then pass if there is a safety zone	
Newark	8 feet	8 feet clear	5 miles per hour
New Orleans	Yes	Except on certain streets	At reduced speed
New York	8 feet	No (but ambiguous)	
Philadelphia	Must stop with car	No, except at direction of officer	
Portland, Ore	4 feet to rear of doors	No	
St. Louis	5 feet	At safety zones, and when 8 feet clear	
San Francisco	No	May pass if 6 feet clear	
Seattle	Yes	May pass if 6 feet clear	

The Baltimore regulations require that the motor car be stopped 3 feet behind the standing trolley, while those of the District of Columbia designate 15 feet. The actual specification in feet appears neither of importance nor useful. Each driver has a different concept as to what constitutes 3 feet or 15 feet. The end to be attained is that the motor vehicle shall not interfere and for that purpose the Cleveland regulation which states

that, "the driver of every vehicle shall stop such vehicle, at the rear of any street car which is stopping or has stopped," appears entirely adequate.

In addition to passing trolleys where safety zones are established, under what other conditions should motors be allowed to go by? It is believed that the following regulation gives the maximum freedom of movement consistent with safety:

> No vehicle shall be speeded up in order to pass a street car which is slowing down. All vehicles shall be brought to a complete stop behind a line even with the rear of any street car which has stopped to load or discharge passengers, and shall not proceed except where there is a designated safety zone, or where it is possible to clear the street car by one vehicle width, and then only in such a manner as is consistent with the safety of persons in the roadway.[1]

The question as to whether street cars should be overtaken to the right or left requires but passing attention. The universal rule in this country is that all vehicles shall be overtaken to the left, with the exception of street cars and that they shall be overtaken to the right. Some cities, however, permit vehicles to pass around to the left of street cars. This is a practice which should be discouraged for though it affords greater facility of movement and greater safety to street car passengers it creates a serious hazard from vehicles being caught between on-coming cars. Overtaking street cars to the right is without doubt the best rule except for one-way streets, where cars are operated in but one direction, and then they may with safety be passed to the left.

Notwithstanding the fact that it seems desirable to give trolley cars the right of way under general conditions, and to place restriction on motor vehicles in their relations with street cars, the latter type of carrier should not escape reasonable control. There are few cities where traffic conditions could not be improved by a rerouting of cars. A careful consideration of conditions in Los Angeles resulted in routing changes which materially reduced the number of car miles in the congested district with no loss of patronage to the company. Pittsburgh has a situation where the greater number of cars entering the business district make a

[1] The enforcement of this rule would be greatly facilitated if surface cars were equipped with green and red tail lights, as they are in Cleveland, the former showing when power is on and the latter when the brakes are being applied.

series of left-hand turns, seriously incommoding other traffic on the streets. The demand of merchants in practically all cities that the more important car lines pass by, or close to, their places of business, results in a concentration of trolley cars on those streets where they cause the greatest obstruction to traffic. Market Street in San Francisco illustrates the climax in this type of concentration. Four tracks have been laid in the street and practically all street cars in the city must pass along this thoroughfare for a distance of many blocks. The concentration results in frequent jams of cars on the lower reaches of the street in the vicinity of the Ferries, blockades of traffic, and hazards to pedestrians who attempt to cross the roadway. These same merchants are often those who most strenuously object to limitations of parking and other regulations which seek to clear the streets, and are at the same time those who are most pressing in their demands that the police do something to make the streets passable. A rerouting of cars may cause but little inconvenience to passengers, and may be desirable even though it means the complete abandonment of certain tracks. An example is afforded in Boston where the Washington Street line was entirely rerouted during the daylight hours, and the street was given over to pedestrians and vehicles.

Regulations should require that every reasonable attempt be made to expedite the movement of street cars in the congested part of the city. On narrow streets the trolleys act as dams in the traffic stream. Under such conditions the actual amount of obstruction offered depends on the length of time the car must remain standing at intersections, and this in turn depends on the time it takes to load and unload passengers. The "pre-payment" or "pay-as-you-enter" car has many advantages over the older type, but it does cause delay. The car cannot move until practically all passengers boarding have paid their fares. A few can, of course, be accomodated on the platform but where many enter they must file one by one past the conductor, with all of the delays incident to making change. Inasmuch as the largest number of passengers board the outward bound cars at the most congested intersections in the business district, the delays are at a place where they have the most serious consequences.

There are a number of methods in use which reduce the standing time. One is the use of a ground collector who takes the fare before the passengers enter the car, or gives them the proper

change. This method is costly and tends to cause undue obstruction in the street. Another scheme is that used in Philadelphia, whereby the car is divided into a front and rear section. All passengers enter through a door at the front. The condutor is located midway in the car. No fares are collected until a passenger desires to leave the car or to pass to the rear section, in which case he deposits his fare in passing the conductor.

A simpler plan, and one which requires no change in the construction of the car is that used in Pittsburgh, whereby passengers board cars on outbound trips by both front and rear doors. There is no delay except that incidental to entering, for fares are paid as the passengers leave in the outlying districts. On the inbound trip fare is paid as passengers enter the rear door, and in the congested districts exit is by both front and rear doors. In this manner the handling of large groups of passengers in the business district has been expedited, and it is understood that in some cities the speed of street cars through the business district has been increased from 30 to 50 per cent by this method of fare collection.

The question of the near- or far-side stop was once of considerable importance, and practice varied from city to city. From the standpoint of traffic movement the near-side stop appears to have every advantage. Where the far-side stop is used it regularly results in double obstruction to other vehicles. The trolley must under most conditions stop on the near side because of cross traffic, and must again stop on the far side for loading. The near-side rule makes it possible for the "traffic stop" time to be used for taking on and discharging passengers.

CHAPTER VIII

REGULATION OF TRAFFIC MOVING ON CONFLICTING ROUTES

If all vehicles moved in the same direction and there was never any necessity for one vehicle to cross the path of another, the traffic problem would be greatly simplified. As in connection with the question of speed, so in regard to crossing, the interests of the individual would seem to demand that he be permitted to move when and as he pleased. The interests of the many, however, demand that each individual have the same privilege of using the street surface and that the movement of all be so regulated that the conflicts which naturally arise shall be controlled with the greatest amount of safety.

The intersection is the crux of the entire street system. No matter to what extent movement be expedited and rendered safe in the general flow of traffic, unless the intersections—the places where vehicle routes conflict—be properly controlled, the street system cannot be used to its fullest efficiency.

The intersection is not only the point which controls movement of traffic but it is likewise the place where the greatest hazards exist. Certain and safe movements of the streams of traffic through these crucial points in the street system will do much to reduce the numbers of street accidents.

As has been pointed out in a preceding chapter, the ultimate solution for the problem of intersecting routes—rail and vehicle, vehicle and vehicle, and vehicle and pedestrian—lies in a physical separation of the warring elements so that it is impossible for them to come into conflict. Grade separations, bridges, and tunnels are expensive constructions, however, and in many places would cause such radical changes in the street plan that they could not be contemplated. But even though the best and surest solution cannot be had at present, there is no reason for cities to neglect to regulate, to the best of their ability, the existing conditions.

When all traffic was composed of horse-drawn vehicles, a definite regulation settling the rights of drivers on conflicting routes was not so necessary. Tangles resulted at intersections it is true, but speed of movement was not considered so essential. With present-day motor traffic, facilitation of cross-traffic movement, and clear regulations regarding the manner of its crossing are imperative. Delays render the motor car less useful, and the speed of vehicles makes conflicts hazardous.

There are a number of reasons why intersections serve to retard the movement of traffic.[1] In the first place it is obvious that where streets intersect a larger number of vehicles will be found. The area of the intersection must carry the full stream which flows into it from two streets, both of which are usually equal in capacity to the crossing. This concentration of vehicle numbers in a single place results in increased density which frequently translates itself into congestion. Then, too, the intersection is the place where many turns are made, both to the right and to the left. Not only are more vehicles present, but they act in a manner which tends to embarrass their neighbors. A turning vehicle demands more space in the roadway than does one moving straight ahead, and not only takes up a greater portion of the street space, but the exigencies of turning require that it proceed more slowly. Intersections, especially those where more than two streets cross, offer drivers the choice of numerous conflicting routes. The driver approaching an intersection must decrease his speed in order to avoid conflicts with other vehicles. The demand for the use of the street space comes from all points of the compass. North and south traffic demands passage, as does east and west. The demands of some must be held in abeyance until the demands of others have been satisfied. Finally, the intersection is the place for the concentration of pedestrians as well as vehicles, and their need for crossing with speed and in safety must also be considered. The intersection therefore presents a place for the concentrating of conflicting interests. Upon the ability of the regulators of traffic to satisfy these demands with justice and safety for all, will depend to a considerable extent the success of the entire traffic system.

[1] The attention of the reader is called to the admirable article by HERBERT S. SWAN, "Speeding Up Traffic at Street Intersections," *Engineering News-Record*, vol. 90, p. 400, to which the writer is largely indebted for this analysis of vehicle behavior at intersections.

THE REGULATION OF RIGHT- AND LEFT-HAND TURNS

One of the most common regulations used by American cities is that governing right- and left-hand turns. Regarding the former the general provision, and a very desirable one, is that all vehicles turning to the right shall stay as close as possible to the right-hand curb. As has been pointed out in Chap. VI, the ability of a vehicle to stay close to the curb depends to a large extent upon whether the radius of the curb is as great as the turning radius of the vehicle. Where the turning car can stay close to the curbing it is clear that it interferes less with the operation of other units of traffic in the crossing. The failure properly to regulate pedestrian traffic makes the working of the rule very difficult in congested streets. The walkers, eager to cross, step down off the curbing and into the roadway, not only creating hazard to themselves, but serving for immediate purposes as an extension of the curb line, and a lessening of its radius. Vehicles are thus forced out into the intersection area, and are unable to turn into narrow streets without encroaching on the path of on-coming traffic on the opposite side of the street.

The most prevalent rule for left-hand turns is that the vehicle pass the center of the intersection before turning. The following ordinance is typical:

> A vehicle turning to the left into another street, shall before turning, pass to the right of, and beyond the center of, the intersecting streets; provided, however, that if directed by a traffic officer the vehicle shall pass in front of, instead of around, the point of intersection.[1]

The rule requiring vehicles to pass beyond the center of the intersection before turning has some merit in that it keeps all vehicles moving in opposite directions on their own side of the roadway, and that it makes it necessary for them to pass each other on the right.

Another support of the regulation is to be found in the supposition that it necessitates an intersection of traffic at right angles, and thus presumably reduces confusion. It is held that:

> As the angle of the intersection is changed more and more away from a right angle, and as the speed increases, the confusion area, or the place in which accidents are more likely to take place, is increased.[2]

[1] *Traffic Ordinance of the City of Buffalo*, pp. 3–4, 1923.

[2] KELCEY, GEORGE G., "Traffic Engineering," p. 7, Elizabeth, N. J., 1922.

There is undoubtedly truth in the principle, and especially as regards the relation between vehicles and pedestrians.

There are certain very serious drawbacks to the regulation, however, which make a modification appear necessary under certain conditions. In the first place the rule makes left-hand turns unnecessarily difficult on narrow streets, and fails to a degree to accomplish the end of having traffic intersect at right angles. The long motor vehicle with a large turning radius, in order to pass around the center of the intersection, must swing out to the right in order to gain adequate room, and in turning must often do so at so great a radius as to trespass into the pedestrians crosswalk. This difficulty of turning sharply is the chief reason why the rule is almost universally disobeyed where there are no officers. Where intersection markers of the button or mushroom type are used they are often passed over or straddled, and where larger signals are used to indicate the center of the intersection of narrow streets they are often sideswiped and destroyed.

The second objection to the regulation lies in the fact that the sharp turn around the center of the intersection can be made only at greatly reduced speed. This may be a merit rather than an objection in outlying districts where traffic is not directed by officers; but at those intersections where traffic is supervised, and the danger of confusion is thus lessened, movement is unduly hampered.

A third objection is more serious. When two lines of vehicles coming from opposite directions wish to make left turns at the same intersection and are required to pass around the center of the crossing before turning, each line must intersect the other at two points, once immediately before turning and once immediately after turning. In both of these intersections there lies potential hazard and delay. If, on the other hand, the lines are permitted to pass in front of, instead of around, the center point of the intersection it will be observed that at no point do the two opposing streams cross. Where the latter rule can be definitely established, and especially where traffic is under the control of officers, it will materially reduce intersection congestion. Drivers, however, should not be premitted to use their own discretion as to the beginning and ending of the short left turn. Crossing markers of some type should be used to direct the course of vehicles, and for this purpose traffic mushrooms

have proved effective. For the placing of such markers the rule now in force in Los Angeles is generally applicable:

> A single marker shall be placed at the intersection of the medial lines of intersecting streets when said streets intersect at right angles, have an average width of roadway of more than 60 feet, and when one of the intersecting roadways crosses the other. All other intersections shall be marked by placing a marker in each of the intersecting streets as near as is possible at the intersection of the medial line of the roadway and a prolongation of the property line of the intersecting street.

The question naturally arises as to how the turns, and especially the turn to the left, shall be synchronized with other traffic movement on controlled crossings. The right-hand turn can be disposed of readily. No matter which way the vehicular traffic is moving at the time the right-hand turn is made the vehicle must cross one line of pedestrians. From the standpoint of the pedestrian, therefore, the question as to whether the right turn shall be made with or against cross traffic is of little consequence. It should be noted that the right turn is the simplest of all movements at the intersection. The vehicle breaks out of the stream in which it is moving without confusion and enters the cross stream at an angle which makes it possible to work in with little difficulty. From the standpoint of the movement of traffic, therefore, there seems to be little reason to prohibit the right turn under any conditions. Such turns, of course, should always be made with due regard to the rights and safety of those on the street surface.[1]

The problem of the left turn is more complex. Assuming that it is to be permitted: Should it be made when the line in which the vehicle is located is moving? Should it be made when the cross traffic is moving? or, should a special interval be allowed for left turns? If the vehicle is permitted to move with its own traffic and turn to the left it is clear that it must intersect the line of on-coming traffic at least once, no matter whether the turn is made around or in front of the center of the crossing-

[1] *Los Angeles Ordinance:* "With due regard to the safety of pedestrians and other users of the street, right turns may be made at any intersection at any time, provided, however, that no vehicle shall be turned to the right at any intersection, or into any alley or driveway, unless the vehicle is at the time in the line of traffic nearer the curb to the right of said vehicle."

This can only be done with delay to other vehicles, and the situation becomes particularly complicated when left turns are being made in both directions.

If the left turn is permitted with the cross traffic the situation is not improved, for instead of crossing the line of on-coming traffic, it must intersect the line of cross traffic coming from the left, and in addition work its way into the line coming from the right when it reaches the far side of the intersection. Moreover, the possibility of making the turn is greatly lessened, for those vehicles desiring the turn, are not always situated at the head of the line in which they stand, and cannot readily break through.

Where the left turn is permitted it seems clear that the best plan is to provide a special traffic change or interval for left-turning vehicles. Three general provisions to arrange vehicles for this special traffic interval have been used. According to the first plan all drivers wishing to turn to the left, must place their vehicles in the lane nearest to the center of the street. No driver who fails to get his car in the proper lane is permitted to turn. This maneuvering is done while traffic is moving. The first vehicle at the head of the line preparing to make the left turn upon reaching the intersection turns slightly to the left before reaching the center of the crossing. The leading vehicle in the left-turning line from the opposite direction is placed in a similar position, thus the right sides of the two leading cars are next each other. As soon as the traffic interval for the through traffic is ended, and before the cross traffic starts, a short period is permitted for the left turns. Since the vehicles are properly lined for this movement and since the turn is made on the near side of the center of the intersection, the clearing is very fast and is accompanied by little confusion. A modified form of this system is to be found on Michigan Avenue in Chicago. On this street the enforcement of the plan and the regularity of its operation is greatly assisted by the use of paint lines on the street surface which indicate the lane in which cars must be placed before they can turn. It is clear that this system will not work on streets which have car lines, unless there is room for two or three lanes of moving traffic in addition to the trolleys.

Another method for controlling left turns is that used in Philadelphia. In that city an ingenious device which is known as the "Traffic Control System" has been instituted. It provides that:

The operator or driver desiring to turn to the left or right at the intersection shall turn to the right-hand curb before approaching the intersection, come to a full stop in the space set out by signs marked "Traffic Control," and shall proceed either to the left or right only upon the signal from the traffic officer.[1]

As soon as a sufficient number of vehicles have gathered in the Traffic Control Zone, the officer in charge of the crossing, stops both through and cross traffic, and permits an interval for the turning movement. In actual operation this method is speedy, because of the arrrangement of the vehicles, and it results in little delay to other traffic. It has the same general merits as those possessed by the Michigan Avenue system and the

FIG. 15.—Vehicles awaiting the left turn interval, Michigan Avenue, Chicago.

additional one that it can be used on street car thoroughfares more readily. It has the apparent disadvantage that the lining up of cars makes it difficult for the pedestrians to reach the loading platforms or safety islands, for boarding street cars. Some benefit results, however, for it tends to make it necessary for prospective street car passengers to reach the safety zone by crossing the roadway at the regular crosswalk located at the intersection. Considering the simplicity and effectiveness of the Philadelphia plan it is surprising that more cities have not adopted it.

[1] *Traffic Ordinance, City of Philadelphia*, sec. 5, part 2. 1922.

A third system for controlling left-hand turns is that whereby drivers desiring to make this movement draw into the right-hand line before reaching the crossing. Instead of stopping in the traffic control zone as in the Philadelphia plan, the leading vehicle proceeds across the width of the intersecting street and comes to a stop. Other drivers desiring to turn to the left line their cars behind. When the through traffic has stopped running, the officer allows the left turn to be made, and the cross-traffic movement follows immediately afterward. In addition to the advantage of regularizing the turning movement, it is claimed in addition for this plan that the lined cars effectively block the improper movement of cross traffic during such time as the through traffic is running, and that it tends to hamper the improper movement of pedestrians against the signals. It has the disadvantage, however, of making right-hand turns out of the cross street difficult during the time when the through traffic is running. It also hampers right-hand turns from through traffic into the cross streets for the waiting cars occupy the lane and street surface which would naturally be used for them. The plan has not been given a thorough trial, and it is doubtful if it will prove as effective as the Chicago or the Philadelphia systems.

The Prohibited Left-hand Turn Rule.—The apparent confusion resulting from left-hand turns has caused a number of cities to abolish such movement at the more important intersections. Los Angeles has gone farthest in its prohibitions, and has made left turns on practically all the downtown streets illegal. The first and most apparent result of the no-left-hand turn rule is to make movement through the intersection much faster and safer. This result comes from the fact that the rule reduces the number of potential conflict points, and eliminates the necessity for a separate traffic period for left turns. With this end accomplished it would appear that there is no reason to object to the use of the no-left-turn rule on any street and at all intersections. There are, however, secondary results which do not appear on the surface which, when analyzed, greatly impair the value of the regulation, and make its usefulness doubtful except in unusual circumstances. Congestion is caused not only by the type of movement, but as well by the amount of demand. This demand may be measured in units of car miles on the streets. A regulation which expedites movement only at the expense of greatly increasing the car miles on busy streets is one which should

be studied carefully before being adopted. An illustration will make the secondary result of the no-left-hand turn regulation clear. Assume that a driver is going east on Fifth Street. His destination is one block north on the next cross street, which for clearness may be called A Street. This will involve but one block of travel. At this intersection, however, left turns are prohibited, and he is forced to pass straight on through the crossing to the next north and south street which may be called B Street. Here he turns to the left, proceeds a block to the north, turns again to the left on Fourth Street, and by driving a block to the west arrives at his destination. Instead of one car block of travel and one left turn, three blocks of travel and two left turns have been necessary. It may be pointed out that the driver in this case could have proceeded by turning to the right at the intersection of Fifth and A Streets, traveled a block south, turned again to the right at Sixth Street, traveled a block west, turned to the right on the next cross street, and by traveling two blocks north, and a block east, reached his destination. It is true that this movement would make no left turns necessary, but it substitutes for the original left turn and block of travel desired by the driver, three right-hand turns, and five blocks of travel. It should be noted that these secondary results of the prohibited left-turn-regulation become especially serious, when the rule is applied not merely to one intersection but to a series. Los Angeles, for example, applies the rule to five consecutive intersections on Seventh Street, and to four consecutive intersections on Broadway.

Does the experience of cities point out any basis for determining where the left turn should be permitted and where it should be prohibited? In the first place it is obvious that there is little sense in prohibiting left turns at a crossing where the street cars regularly make this movement. The vehicles should be permitted to turn with the trolleys. Secondly, left turns should not be prohibited to consecutive intersections on the same street for thus a serious diversion of traffic is necessitated as has been noted above. Thirdly, there is no need to prohibit left turns on any street where vehicles can be held for release as in Chicago or Philadelphia. There are several situations where the value of the rule may outweight its disadvantages. One is to be found where an intersection is overburdened with pedestrians. Left-turning vehicles must of course always pass through one lane of

pedestrians who are moving with the signal. Care should be taken, however, that in the attempt to relieve one intersection of this type of conflict, another near by is not overburdened. In rare cases the prohibited left-turn-regulation may be used to advantage to protect an especially difficult intersection by diverting traffic away from it.

Driver's Signals in Turning.—Should drivers who intend to turn to the right or the left be required to indicate their intention by signaling? And if so, what type of signal should be required? In most states no signal other than one that is audible or visible is required, while in others specific signs are designated. In Detroit, for example, a driver wishing to turn to the left holds his arm out in a horizontal position, and if he wishes to turn to the right he signals by extending his arm and moving it forward.

In Massachusetts the following rules are in force:

1. *To Stop.*—Extend left arm, hold stationary.
2. *Left Turn.*—Extend left arm, point with finger.
3. *Right Turn.*—Extend left arm, rotate rear to front.
4. *To Back Up.*—Extend left arm, move arm up and down from horizontal position.

The Baltimore regulation merely provides that the operator about to stop or turn to the left shall give a signal to those behind, by extending or raising the hand or by a suitable mechanical device. Indeed, practically all of the later codes make provision for the use of mechanical and automatic stop and direction signals.

It is unfortunate that at least in respect to signaling there should not be a greater uniformity among the several states and cities. The amount of interstate and interurban traffic now existing makes it imperative that drivers in strange communities should know how to operate their cars in harmony with those of the locality.

In actual practice the Detroit and Boston signals appear confusing, and careful observation leads to the belief that the signal code developed in California and now generally used on the Pacific coast is the clearest and most practicable. The directions are given in the California State Vehicle Act, Sec. 130, 1923:

Whenever the signal is given by means of the hand and arm, the driver shall indicate his intention to turn to the left by extending his arm and hand horizontally from and beyond the left side of the vehicle, his inten-

tion to turn to the right by extending his hand and arm upward and beyond the left side of the vehicle, and his intention to stop or suddenly to decrease speed by extending his hand and arm downward from and beyond the left side of the vehicle.

The signal herein required to be given before turning to the right or left, whether given by means of the hand and arm, or by means of an approved mechanical or electrical device, shall be given continuously during the last 50 feet traveled by the vehicle before turning.

Traffic Squares and Regulated Turning.—It is generally considered that a "traffic square" or plaza, works for the facilitation of traffic movement. It is true that it does afford added area where vehicle routes intersect. Unless traffic moving through such squares is carefully directed and regulated there is, however, much chance for delay and hazard. Where drivers have room to maneuver and are not held in line by vehicles surrounding them their course tends to become wavering and erratic.

The problem of the large street area is well stated as follows:

> In large areas, such as public squares, traffic must be confined to definite roadways, and not allowed to spread itself over the entire area. Crossing such limited roadways, the pedestrian has the same protection as at an ordinary intersection. A pedestrian in a large area, where traffic is not restricted to definite roadways, is helpless in the confusion of vehicles moving in all directions.[1]

Such a confinement of traffic cannot be brought about by mere printed rules. Some type of physical obstruction, signals, signs, or paint lines, is necessary. As a general principle, routes should be marked out which are not wider than the streets entering the square.

The Alignment of Traffic at Intersections.—There is need at intersections for more careful supervision of the alignment of traffic than is required elsewhere. One kind of vehicular movement which seriously limits the discharge factor of the intersection results from the habit of drivers of placing their vehicles in such a manner as to reduce the number of lanes of traffic which can pass. The roadway at the crossing is usually restricted at best, the average street allowing for no more than two lanes of vehicles between the safety zone and the curbing. If these two lanes are filled with lines of moving or waiting cars, the capacity

[1] KELCEY, GEORGE G., *Traffic Engineering*, p. 10, Elizabeth, N. J., 1922.

of the crossing will be kept at its highest point. If, however, instead of two lines, but one is possible, due to the fact that cars straddle the center of the roadway, it is clear that it will take twice the time for the vehicles to pass through. The alignment of vehicles is difficult to bring about. Paper regulations have little effect. Where the intersection is one of vital importance it may be worth while to have traffic officers especially assigned to the duty of directing vehicles into proper channels so that the largest number of lanes consistent with the roadway at the point will be obtained. Such is the practice of Boston at a number of the more heavily traveled intersections, and the results have been greatly increased capacity.

Another plan is that used by the city of Buffalo. The part of the roadway between the safety zone and the curbing has been divided by paint lines indicating the lanes into which vehicles should move. Near the intersection there is placed a sign directing drivers to keep in their own line and not encroach on the adjacent lane. The working of this plan, when observed by the writer, was not highly successful, but it is a step in the right direction, and it is believed that with the proper education of the public, and attention of the police to its enforcement, this regulation will serve to increase the capacity of intersections.

Right-of-way Rules.—Even where the movement of vehicles on conflicting routes has been simplified, and the capacity of the intersections has been increased to the fullest extent, there still remains the problem concerning the respective rights of those who wish to pass. It has been said that:

> The supreme rule of the road as to automobilists at street intersections in cities is the rule of mutual forebearance.[1]

This would be an ideal rule were it not for the fact that all persons do not possess the same degree of forbearance. Strictly applied everyone would hold back for everyone else, and while a great deal of brotherly feeling might be engendered by the process no great facility of movement would result. On the other hand certainly no one would advocate the rule of mutual greediness. Rules must be laid down which will so clearly define the rights of drivers on conflicting routes that their duties will be explicit, and their rights legally enforceable.

To this end most cities have in their codes "right-of-way" rules, that is, a statement setting forth the conditions under

[1] *Ward* v. *Clark*, 232 N. Y., 195.

which certain vehicles have the right of priority. This regulation takes two forms: priority based on direction of travel; and priority based on the relation of the vehicles at the crossing. Of the former type the following regulation of the city of Cleveland is an example:

> Vehicles and street cars going on main thoroughfares running in a general east and west direction shall have the right-of-way over those going on intersecting main thoroughfares. In all other cases vehicles going in a general east and west direction shall have the right of way.[1]

This rule may be desirable in cities where it is necessary to move traffic in certain directions with greater expedition, but it is subject to misunderstanding. Where streets do not run true to the compass, or where they curve, it is difficult for drivers to know whether they have the right-of-way or not. Moreover, many drivers, and especially strangers in the city are not fully acquainted with the points of the compass in the locality.

The better method, and certainly the one which is more widely used is to determine the prior rights of drivers at intersections on the basis of their relation one to another. The regulation which is almost universally used in this country is illustrated by the following rule:

> When vehicles approach an intersection of two or more streets at the same time, the vehicle approaching from the right shall have the right of way.[2]

It should be noted that the above regulation, while typical of those used by American cities, is not sufficiently definite. How far are vehicles from an intersection when they are approaching it? When the two drivers are in a position to see each other the slower vehicle may be closer in feet to the crossing, but the faster vehicle may be closer in time. At what distance from the actual crossing of the routes are their relative distances from the point of intersection to be judged? The actual entrance into the street intersection by a crossing of the sidewalk lines appears to afford a sufficiently definite test. This test is reflected in the following rule:

> A vehicle entering an intersection of public highways at a lawful speed shall have the right-of-way over a vehicle approaching from its left

[1] *Traffic Code of the City of Cleveland*, sec. 2265 B, 1922.

[2] *Detroit Street Traffic Ordinance*, part 2, sec. 9, 2nd ed., 1920.

unless such vehicle approaching from the left shall have first entered into such intersection at a lawful speed in which event the vehicle on the left shall have the right-of-way.[1]

The desirability of the rule which gives vehicles approaching from the right the priority has frequently been attacked on the ground that it causes delays and creates hazards. It is claimed that where the rule is used vehicles tend to become "locked" in a mass in the center of the intersection, and can be freed only with difficulty. Also it is said that the chief attention of the driver when approaching cross streets should be toward the center of the intersection where the officer is usually stationed, and toward the traffic approaching from the left, inasmuch as this stream is the one which the driver must first cross. There is much merit in these objections, and wherever possible the rule should be changed to require the driver from the right to yield the right of way to the driver from the left.

The desirability of giving right-of-way to street cars has been previously discussed. There are other vehicles in the city which also demand consideration. Ambulances, police vehicles, and fire apparatus, are usually accorded immunity from the general regulations, and are often given specific right-of-way over all other traffic. The privilege should be granted to such vehicles only, however, when actually engaged in emergency duty.

Boulevard Stop Regulation.—In every city there are certain streets which, because of their location, width, or the amount and type of traffic which they carry appear to be of paramount importance in the traffic system. Just as in railroad practice where the trains on the main line are given a right-of-way over those entering from the sidings, or crossing on inferior lines, so in the regulation of street traffic there has been a tendency of late to designate certain important thoroughfares as "Boulevard Stop Streets," or "Traffic Ways," and to give vehicles traveling on them priority over all vehicles entering from side streets or crossing on intersecting ways. This regulation was first used in Chicago for the park boulevards, and proved so successful that it has been adopted by a number of other cities, among them, Detroit, New Orleans, and Los Angeles. The Chicago ordinance provides that it shall be unlawful for any vehicle to be driven

[1] *California, Motor Vehicle Act*, sec. 131, 1923.

onto any boulevard without first bringing the vehicle to a full and complete stop. While this regulation does not definitely grant the right of way to the vehicle traveling on the boulevard the effect is practically the same. The result of the regulation is that drivers on the boulevard street can move at a speed of from 25 to 30 miles per hour without fear of sudden obstruction from vehicles entering from side streets. Experience with the system in the cities where it has been tried does not appear to indicate that it creates undue hazard. The safety of the plan will depend upon the rigidity of enforcement and the willingness of the public to abide by the provisions. Dangers will result if drivers on the right-of-way streets are given an assurance of freedom from interference which in fact does not exist.

The success of the plan depends to no small degree upon the distinct and adequate marking of the *boulevards*. The public cannot be expected to remember at which streets they must stop before proceeding. One city attempted to install the system after advising the public through the newspapers, but without erecting signs. The regulation was almost universally disobeyed. The plan used in Detroit provides paint signs on the pavement showing that the cross street being approached is a *boulevard stop street*, and indicating by a line the place where the stop must be made. Even with these precautions, violations are not infrequent.

The purpose of the *boulevard stop* regulation is to expedite the movement of traffic on certain streets of major importance, and to this end places an obligation on all persons entering such streets to do so in an especially cautious manner. The privilege of unmolested passage given to drivers on the right-of-way streets should never be understood to free them from the exercise of due caution in their relations with other drivers upon or entering the street. The city of New Orleans adds to its right-of-way regulations the following desirable definition of the respective rights of drivers:

> The right-of-way herein given shall not be construed to mean that vehicles may be driven through street intersections in a reckless manner or at a speed beyond control, nor that they may take advantage of such right-of-way to drive through intersections regardless of the rights of vehicles on intersecting streets. The right-of-way given applies only when two vehicles approaching intersecting streets arrive at the intersection at approximately the same time, and does not authorize the

vehicle traveling on the right-of way streets to disregard the rights of vehicles which have already entered the intersection from an intersecting street.[1]

When two *boulevard stop* streets intersect vehicles on both of the protected streets should be required to come to a full stop before entering the intersection. Where this rule has been used it has had the very desirable effect of relieving intersections which formerly were badly congested. Drivers having stopped their vehicles tend to wait for a suitable opening before entering the crossing.

Block and Multiple Block Movement.—In order to equalize the rights of drivers coming from different directions two general methods of regulations have been used. One is known as the block movement, or sometimes by the descriptive name of the stop-and-go regulation. By this scheme north and south traffic is stopped, and east and west drivers proceed. After the elapse of a reasonable period of time, this traffic is stopped and north and south traffic is given its opportunity to go.

The other method is known as the gyratory, or rotary traffic regulation. A somewhat heated controversy has arisen regarding the relative merits of these two methods of regulation. An analysis will show that each method has certain advantages under various conditions, and that each has faults which makes its universal application undesirable.

The block system is the one most widely used in this country. It has the advantage of giving traffic from various directions alternate opportunities to pass through the intersections. The chief objection to the block movement is that it brings about an inefficient use of the street space. It breaks traffic up into relatively short trains, and results in high density on certain portions of the street space while other parts are left entirely empty. Moreover it places emphasis on stopping traffic rather than on passing it. The real test of any regulation, however, is to be found in whether or not it does the work better than any other method, and for most of the narrow, busy city streets it is apparent that nothing better has been devised.

A recent development of the block system which is known as multiple block movement, or synchronized control, holds great possibilities, and may ultimately result in making the block plan

[1] City of New Orleans, *Ordinances Governing Street Traffic*, art. 1, sec. 7, part G, 1923.

much more effective. This method of regulation was originated in Detroit in connection with the traffic crows-nests, or towers in which the traffic officers were placed at intersections. Instead of each crossing being opened and closed as an isolated unit the officers found that they could handle more traffic by working the signals at adjacent intersections in unison. In this manner drivers did not have to take a chance on being stopped at each intersection, for once they were permitted to proceed they could continue moving through several consecutive intersections before being again stopped for cross traffic. A development of the system was undertaken in Detroit, and instead of making the uniform operation of the officers optional, they were required to open and close their intersection for the various traffic movements according to signals from a master tower located at Woodward and Michigan Avenue—the intersection bearing the heaviest cross traffic. In order to make the signals from the master tower visible to the officers in the other towers up and down the street, and to drivers, a system of lights and signals was devised. The green light flashed toward the driver accompanied with the ringing of a bell meant that he was free to move. A yellow light meant that there was to be a change in the direction of movement and that those who were proceeding should prepare to stop at the next intersecting street, and that those waiting for release should prepare to move. The red light flashed toward a driver meant that he must remain standing.

The use of this method of control received the admiration of many who observed its workings. To see an entire street full of cars moving and stopping at the same time gave the impression of great neatness and system, together with an impression of a perfect control exercised by the police over traffic behavior.

The synchronized control was adopted with some modification for Fifth Avenue in New York City and is now being tried on other thoroughfares in that city. The operation of the system on Fifth Avenue is described by Dr. J. A. Harriss who was instrumental in having the plan developed in New York City.

> Traffic on the Avenue starts as a unit, moves for a certain length of time, and is then stopped, giving an opportunity for traffic on the side streets, which has accumulated while traffic was moving on the Avenue, to cross the Avenue at the various intersections. The unison of all traffic is virtually clocklike and certainly efficient. Indeed by actual test under old conditions it was found that a vehicle required as long

as 40 minutes to proceed on Fifth Avenue from Fifty-seventh Street to Thirty-fourth Street, or in a reverse direction—a mere matter of a mile or so—at certain times of the day. Under the new traffic regulation, however, this annoying and costly delay has been reduced by more than 60 per cent.[1]

The apparent success of the plan in New York City has caused other localities to undertake similar installations. In Philadelphia the system has been installed on North Broad

FIG. 16.—Fifth Avenue signal tower.

Street for a distance of 2 miles. The north and south traffic is permitted to run for a period of 2 minutes, and observations indicate that vehicles are able to cover in this time a distance of from eight to ten blocks without stop.

Los Angeles has adopted the plan for practically all of the downtown intersections. The most recent and most interesting synchronized installation, however, is on Michigan Avenue in Chicago. The system covers a distance of approximately 2 miles south from Lake Street. Three so-called master towers have

[1] *Scientific American*, p. 92, Feb., 1922.

been erected over this distance, each costing approximately $2,000, equipped with automatic time controllers. The master towers are built on pre-cast cement columns supporting a house of frame work reinforced with steel. The towers are 23 feet high and carry at the top, above the compartment for the officer, three signal lights. These lights have 8-inch lenses and can be seen for a distance of a mile or more in sunlight. The three colors used for signaling are: yellow for caution and change warning, red to stop, and green to proceed. At each intersection between the large towers there are signal posts 10 feet in height supporting lights identical to those of the master towers. The entire light system is operated as a unit, the intervals being determined by an automatic control.

The most recent refinement in signaling methods is one which attempts to keep traffic in constant motion. The signals on a thoroughfare are not all opened at the same time, but in succession from one end of the street to the other. The time elapsed between the flashing of the go sign in the first signal and in the one at the next adjacent intersection is determined by computation on the basis of average traffic speed through the intervening block. Cross traffic moves between the waves of traffic on the through street, and by alternating the waves on parallel through streets it is anticipated that constant flow will be possible on all thoroughfares. The success of the system depends largely upon the ability of the operator of the master station to determine the speed of traffic flow accurately, and upon street conditions which permit a fairly constant speed. The plan is the most promising yet devised.

Unfortunately most of the experiments with synchronized signaling have been made without the collection of adequate data. It is not possible to tell whether or not the installations in most cases have helped or hindered traffic movement.

Observation of the actual working of various systems appears to establish certain conclusions regarding the conditions under which each should and should not be used. The system reduces the time intervals for the two traffic movements to a predetermined period.[1] The period for traffic movement across the synchronized street must be long enough to accommodate the traffic on the most heavily traveled cross street, thus Woodward Avenue in

[1] Thus Woodward Avenue in Detroit moves for 1½ minutes, and is held 1 minute for cross traffic; North Broad Street runs for 2 minutes and is held

Detroit is held for Michigan Avenue, Fifth Avenue for Forty-second Street, in New York, and Michigan Avenue, for Jackson Boulevard, in Chicago. If it could be assumed that all cross streets carried an amount of traffic nearly equivalent to that of the most important cross street, there would be little inefficiency in holding up the entire controlled street long enough to clear the vehicles from the most important cross thoroughfare. This assumption is one which can rarely be made with accuracy. Where there is a great variation in the traffic demands of the cross streets the minor streets will clear in a few seconds, while the major streets may take a minute or more. Where the single block system is used cars on the controlled street are permitted to move along to their destinations as soon as each intersection has been cleared of crossing vehicles. But not so under the synchronized system. No matter whether the intersection at which a vehicle has been stopped on the controlled street is being used by cross traffic or not, the vehicle must wait a length of time which has been predetermined as necessary for the master intersection, which may be a mile away, to clear its traffic. The same unnecessary delay is occasioned in cross traffic as well, when there is a fluctuating demand on the controlled street. On all of the synchronized streets in the country one will see, especially in the off-rush hours, groups of vehicles standing at intersections where they have been stopped by signal, although the intersection ahead of them is entirely free from traffic. Uniformity of demand has been assumed where it does not exist. Detroit has felt the inefficiency which results from a too great rigidity of synchronized regulation, and orders have been issued to the police to pass traffic against the signals. This would seem to work for a proper

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1½ minutes except during the rush hours when it is stopped for but 1-minute periods; while Michigan Avenue has the following timing:

	Michigan	Cross streets
7:30– 8:00 a. m	90 seconds	50 seconds
8:00– 9:00 a. m	80 seconds	60 seconds
9:00– 4:00 p. m	90 seconds	50 seconds
4:00– 6:30 p. m	80 seconds	60 seconds
6:30–12:00 m	90 seconds	50 seconds

modification of the system were it not for two things. In the first place it appears to be a bad practice to sanction officially disobedience to a signal which has been definitely set against a driver. And secondly, officers will rarely use their discretion in the matter; it is easier and safer to pass the responsibility to the system. As a result of these considerations one may conclude that the synchronized system has the best chance for success in those cities where the street plan is regular and where the capacities and demands of all streets intersecting the controlled street are approximately uniform, or where the density of traffic is such that there is practically a constant demand for movement from all directions at all times.

The effect of synchronized movement on rail traffic demands consideration, and creates serious doubts as to the desirability of using the system on streets where trolley lines are operated. As has been pointed out previously street cars differ from other vehicles in that the time when they can proceed must be regulated by the completion of the loading and unloading of passengers. They are not flexible. Where the single block system is used an intelligent officer will attempt to move out the street cars as soon as possible after the completion of their business. The regulations are made to fit the demands of the most important and most obstructing traffic unit. The synchronized control, however, is regulated according to predetermined time intervals. Street cars are often given a mechanical signal to go just as they stop at the loading zone; and a signal to stop, just as they have completed their business and are ready to proceed. The writer has been informed by an official of the street railway company in one of the cities where the synchronized movement is used, that the regulation has reduced the number of trolley cars which can cross the controlled street in a given time by 30 per cent.

The use of towers for the lights and officers is another drawback which should be noted. At best, intersection areas are too restricted for the burdens which they must bear and the placing of a tower in their center adds a further limitation. The location of the officer at an elevation has some advantages in giving him a more extended view of traffic, but this has no particular merit, for signals are not given according to the traffic needs of the moment. The elevation has the disadvantage of removing the officer from the street surface making it more difficult for him to caution offenders, give directions to individuals, and ade-

quately provide for safety under special conditions. It is interesting to note that the tower control idea has been discarded by New York City in recent installations and that the lights are held by brackets to poles at the curb line.

The cost of the synchronized system is another consideration. The Los Angeles installation cost approximately $50,000 and the Chicago installation a total of $40,000. These sums are, of course, small if the results are commensurate with the claims of the installers. In no city where the lights have been installed in the central district has it been found possible to dispense with the services of policemen to enforce obedience, and to assist in straightening out tangles. Moreover, the upkeep of a fairly complicated electrical apparatus is an item which must be considered.

With the above consideration in mind one may conclude that under special conditions the synchronized movement of traffic has certain advantages, but that it has limitations which should make cities cautious of elaborate installations without adequate investigation and experimentation. Once a large amount of the city's money has been spent for a control system those responsible for the expenditure are under a certain amount of political necessity to prove that the plan is a success.

It is suggested that those cities which desire to experiment with synchronized movement may readily do so at slight expense by installing on the desired intersections, bells, or buzzers, which would indicate the direction of movement by one and two rings. These bells could be connected in series and operated by an officer at the master intersection. By means of careful counts made before and after the installation it would be possible to determine to what extent traffic was expedited or retarded by the system.

Rotary Traffic Control.—To the block method of control the rotary system forms an interesting contrast. A consideration of its characteristics and requirements will indicate the circumstances where it can be used to the greatest advantage.

In brief the plan of rotary movement, as the name indicates, proposes that traffic should not be stopped by blocks, but that it should be kept rotating in constant motion. The end is to be obtained in the following manner. No vehicles are permitted to cross directly the paths of other vehicles; and passage directly

through the intersection is not permitted. In the center of the crossing there is erected a circular island, varying in diameter according to the size of the intersection. A vehicle upon approaching a control of this type turns to the right around the center island, by working its way into the line of cars that is rotating about. Upon reaching a point in this circular roadway opposite the street upon which the driver wishes to proceed the car is turned out of the line and goes on its way. The merits of the plan are apparent. Theoretically no vehicle need cross the track of another vehicle; all traffic moves in the same direction through the intersection; vehicles are not broken up into trains and the result is that instead of a part of the street space being

FIG. 17.—Roadway arrangement, Scott Circle, Washington, D. C.

packed densely with cars and other parts left empty, traffic is distributed evenly over the surface of the roadway.

It will immediately appear to the observer that the effectiveness of the system will depend to a large extent upon the size of the island which can be erected in the center of the intersection. If this island is 1 foot in diameter or the size of an ordinary intersection button it is clear that rotation will be no more effective than movement under the regulation which requires that all vehicles pass beyond the center of the intersection before turning. If, on the other hand, the island is 100 feet in diameter the turn-

ing radius will be such that a considerable speed will be possible, and the angle at which a vehicle can enter the rotating stream will be so reduced that the movement will be greatly facilitated.

The most outstanding examples of successful operations of rotary traffic are to be found at those intersections where a large area is available for traffic use and where it is possible to have the vehicles move around to the right on an easy curve. The occasional circles in Washington where a number of streets converge afford a situation where rotary traffic can be, and is, used to the greatest advantage. Scott Circle is one of the most interesting examples. At this point eight streets converge, Sixteenth Street being the principal traffic artery. In the center of the circle there is a monument around the base of which is a planted circular area. The remainder of the area of the intersection is divided into an inner and an outer circular roadway, which are separated from each other by a narrow walkway raised several inches above the surface of the pavement. In this walkway there are openings opposite the entrances of Sixteenth Street. Through traffic along Sixteenth Street enters the circle, passes through the opening to the inner roadway, and proceeds around to the right of the monument, and makes its exit through the opening on the opposite side of the circle. Traffic which enters or exits by any of the other converging streets moves around to the right in the outer circular roadway.

Columbus Circle in New York affords another example of the successful operation of the rotary principle, though there it has been necessary to modify the system somewhat by using the stop-and-go regulation, to permit the passage of street cars which run through the intersection.

There can be but little doubt that where the intersection is of ample size the rotary principle is by far the most desirable. Since the success of the plan depends to a large extent upon the possible radius which can be given vehicles for turning, it is well to ask how small an intersection will accommodate the system. William Phelps Eno, the originator of rotary traffic, states that an inscribed circle of 65 feet allows sufficient room for successful operation. As an interesting commentary on the usefulness of the plan under such restricted conditions it may be noted that it has been attempted in various cities, but that in practically all cases it has been discarded after a thorough trial. Unfortunately these experiments have been carried on without the

collection of adequate data from which estimates concerning the actual working of the plan can be obtained.

The effect of rotary traffic on safety was studied at two intersections in Los Angeles by E. B. Lefferts, to whom the writer is indebted for the information. Under the block movement at the intersection of Wilshire and Western Avenues the average number of accidents per month was 12.5 and the average property damage per accident was $29.82. After the installation of rotary movement the number of accidents fell to 5.5 per month, and the average cost per accident to $11.17.

Notwithstanding the advantages which rotary traffic appears to possess on paper, and its obvious success at intersections of large area, it is doubtful if it offers a suitable plan for the handling of traffic at the narrow intersections of congested streets.

It should be noted that at busy intersections the system of rotary traffic has one very serious disadvantage. Pedestrians must cross the street at some time, but if traffic is to move constantly they can do so only by rushing through the lines of moving vehicles. Several alternatives are proposed. The vehicles may be stopped occasionally for the movement of pedestrians. In this case, however, the plan loses its chief merit—that of providing for constant movement of vehicles. The other alternative is that subways or overhead bridges should be provided for the use of pedestrians. This is the plan which has been devised by M. Eugene Henard, Architect of the City of Paris, for installation at the Place de l'Opera, where rotary traffic is used.[1]

[1] Report by WILLIAM PHELPS ENO, *Fourth Permanent International Association of Road Congresses*, p. 1, 2nd sec., Rennes, Paris, 1923.

CHAPTER IX

REGULATION OF THE STANDING VEHICLE

The aspect of the traffic problem which has gained the greatest attention of the public, and that about which the greatest controversies have been waged is that presented by the standing vehicle. The driver who finds his passage blocked by vehicles ahead of him casts his eye on the lane occupied by the line of parked cars at the curbing and contemplates the ease with which he could proceed if this lane were used for moving traffic instead of for the parking of cars. The merchant whose place of business is located on the street is torn between two thoughts. Where parking is permitted the available space is always filled, and often by cars which are left for long periods of time. He sees potential customers, who wish to stop, go by his place of business to seek a standing place elsewhere. His one desire is that parking should be prohibited to such a degree that his customers could stop, and he often gains permission to erect "No Parking" signs in front of his place of business. Whenever there is a proposal to abolish all parking, however, he is usually on the defensive.

The Relation of the Standing Vehicle to Street Use.—This problem of the standing vehicle which appears to involve so many conflicting interests, and to possess such complications, appears more simple, when the ultimate requirements of the traffic situation are borne in mind, and the problem is analyzed into its component parts. Everyone will agree that the streets were originally designed for the purpose of moving people and commodities from one point to another in the community, and that any obstruction which an individual may wish to place in the street which is for his private good only, should with propriety be removed for the good of the public as a whole.[1] Thus

[1] DILLON, JOHN F. "Commentaries on the Law of Municipal Corporations," vol. III, sec. 1168; 5 vols., Boston, 1911. "We have shown that the primary purpose of a street is for passage and travel, and that unauthorized and illegal obstruction to free use come within the legal notion of a nuisance. They can be justified when, and only as long as, they are reasonably necessary."

the leaving of materials, or the erecting of private structures in the street is a public nuisance, and should be prohibited by the authorities.

While the streets are for traffic and not for storage, it is clear that the stopping of a vehicle at the curbing for a reasonable length of time is actually an integral part of transportation. Travel in no wise benefits a driver if, after having proceeded to his destination, he is unable to stop and discharge his freight or passengers, which was the sole reason for the trip. When, however, the driver demands that he be permitted to stop his car in a position which serves to create an unnecessary obstruction to other travelers who are proceeding to their destinations; or when he demands the right to leave his vehicle for a longer period of time than is necessary for the consummation of that part of his business which is reasonably connected with the act of transportation, he is asking for a privilege in the streets for which they have not been designed. Such action may properly be declared a public nuisance, and whether it should be tolerated in any community depends upon the degree to which the act deprives the general public of its right to use the thoroughfares for the business of transportation. As a general rule it may be taken that when the use of a street for standing vehicles impairs the use of the street by moving vehicles, the privilege should be limited.

A Classification of Standing Vehicles.—All vehicles standing at the curbing are not alike, however, and it does not seem fair nor possible to treat them all in the same manner. A consideration of the types of standing vehicles, on the basis of the purpose for which they are standing, will indicate the type of treatment which should be accorded to each class.

In the first place there is the vehicle which has been stopped for the loading or the unloading of merchandise. So long as the process of transferring the goods from the sidewalk to the vehicle, or *visa versa*, is in progress, an act which is essentially a part of transportation is being carried on. Moreover, a fundamental service for the business of the city is being performed which could not be carried on in any other manner, and without which, business would be rendered impossible. So, likewise, with the vehicle which has been stopped for the loading or unloading of passengers. This type of standing vehicle is the least objectionable from the standpoint of the

obstruction which it offers, for the obstruction is no longer than is necessary for the consummation of the transfer of persons or goods. Regulations, however, should assure the public that the function will be carried out with expedition, and at such a time and in such a manner, as shall result in the least impairment to the rights of other users of the street.[1]

The second type of standing vehicle is that which may be said to be left in *live parking*, *i.e.*, left in charge of a driver who can upon signal yield the space to another vehicle which desires to stop for the loading or unloading of passengers or commodities. While standing, this vehicle is performing no service which is immediately connected with transportation; waiting for a passenger has merely an indirect connection with the carriage of such passengers. However, it is obvious that the vehicle does not form a dead obstruction to traffic, for it can move out in case there is a demand for the space.

The third type of standing vehicle is that which has been left for an indefinite time, in what may be called *dead parking*, or storage, while the driver transacts business which has no direct connection with the transportation of his person over the city streets. This use of the street surface is the least defensible of any. It is the out-and-out use of a valuable piece of public property, dedicated for the purpose of transportation, for the storage of a piece of private property. That the privilege is of value to the individual owner is not to be doubted, but where it can be exercised on busy streets only at the expense of the other users of the street, it creates a nuisance and should be abated by public officials.

Prohibited Parking Regulations and Street Capacity.—With these three types of parked vehicles in mind one may proceed to a consideration of the effect which they have upon moving traffic, for this element likewise affects the regulations which should be made. For the sake of simplicity assume a one-way street capable of carrying three lanes of traffic. If parking is permitted along the right-hand curb, the capacity of the street is reduced to two lanes, and thus the demand of the public for

[1] *Los Angeles Ordinance.* "No vehicle shall be stopped for a period of time longer than is necessary for the loading or unloading of passengers or materials, provided that the loading or unloading of passengers shall not consume more than 3 minutes, nor the loading or unloading of materials more than 20 minutes . . . "

space to travel through the street has been reduced one-third by the storing of vehicles by a few individuals. Where the street is of sufficient importance, and the demand for street space sufficiently great, a contemplation of this situation leads to the suggestion that parking be prohibited, for thus it is assumed that traffic will be able to use all three lanes in the street. If the assumption were correct it is clear that the prohibition would be justifiable. It is not believed, however, that such an assumption can be made correctly. Even though *live* and *dead* parking be prohibited, if vehicles are still permitted to stop for loading and unloading the moving traffic will not regain the third lane.

FIG. 18.—An illustration of the effect of one standing vehicle on street capacity, Michigan Avenue, Chicago.

On a busy street, presumably at least one vehicle will be stopped the greater part of the time in each block for the purpose of letting down or taking up passengers, or transferring goods. Even one or two such vehicles in each block destroys the usefulness of the traffic lane in which they are standing, for in dense traffic drivers will not pull into the line behind a stopped vehicle for fear of being "boxed"; that is, put in such a position that they cannot proceed because of the vehicle ahead. Observation on any busy street reveals the fact that one standing vehicle, during the period that it is stationary, renders useless the lane behind it for such distance as it can be observed by approaching drivers. Prohibited parking regulations therefore must contain a provi-

sion against the stopping of vehicles in the street for any purpose, if moving traffic is to regain the third lane. Such a provision makes impossible an act which is an essential and necessary part of transportation over the streets, and would not prove acceptable either to users of the street or to merchants located upon the thoroughfare. These considerations would lead one, therefore, to believe that prohibited parking would be of little assistance in decreasing traffic congestion. Such a conclusion would be justified, were it not for one other consideration. Where parking is permitted the places are taken by early comers, and those who arrive later find it impossible to draw up to the curbing. Among these late comers are many who have actual business to transact, such as discharging passengers or unloading goods, and being unable to find a place next to the curbing they not infrequently stop in the second lane, and create an evil which is generally known as *double parking*. In this manner the permission for indiscriminate storing of cars along the curb often results in the reduction of available traffic area by two lanes instead of one. This secondary effect of parking is in most cities a phenomenon of fairly recent origin, and is a sign of the supersaturation of the streets. It is a practice which has been observed in all of the cities from Boston to Los Angeles, and on some thoroughfares has been carried to such an extent that it is literally impossible for moving traffic to pass through for considerable periods of time.[1] Notwithstanding police regulations drivers who cannot find a place at the curbing will stop in the stream. Double-parking in many cases is, of course, the result of the unwillingness of the drivers to find a place to stop which will cause less inconvenience to the public. In many cases, however, the action is one caused by actual necessity. A truck driver, for example, has heavy

[1] *New Jersey State League of Municipalities, Special Report*, 99, p. 1. The Chairman of the Chicago Committee on Local Transportation says: "When parked vehicles take the space at the curb, they thereby reduce the useful width of the street from one-third to one-half, and they compel commercial vehicles to stand in second line, abreast of parked vehicles, in order to load and unload, thereby reducing the use of the street two-thirds, and in some cases rendering it null and blocking traffic entirely. An example of such a condition is to be found on any street almost any time. On some streets the parking of cars in two, three, four, and five lines hardly permits the passage of a single vehicle, and traffic in the Loop being a continual procession such an obstruction means an obstruction of the entire Loop traffic."

packages to be delivered at a business house. Upon reaching his destination he finds that the curbing is filled with stored cars, a condition which may extend for several blocks. He has several alternatives. He can return the goods to the sender, in which case a desirable and necessary economic service would have been defeated. He may cruise around the block until such time as an opening presents itself, in which case he merely adds unnecessarily to the density of the traffic stream. Or he may, as most drivers do, under the circumstances, stop his car alongside of the parked cars, and proceed to unload his goods.

Conditions under Which Parking Should Be Prohibited.— When a point of saturation has been reached on any thoroughfare to the extent that essential actions, directly connected with transportation, are defeated, or carried on only by means of double-parking, it appears to be time that traffic regulations should bring about an elimination of those vehicles which are using the street space purely for storage purposes.[1] This end can be attained by the simple regulation that no vehicle in a given street area shall stop other than close to the curb, and then, only for so long a time as shall be reasonably necessary for the actual loading and unloading of passengers or merchandise. This provision will not regain for moving traffic an extra lane next to the curb, but it will in most cases make possible the easy consummation of that part of a standing vehicle's business which is connected with transportation.

In addition there are other circumstances under which the standing vehicles of all three classes should be prohibited. The first is to be found where the stopping of vehicles at the curbing results in the creation of a *bottle neck*. If, for example, a street which is heavily traveled is narrower by 10 feet or the width of a traffic lane for the distance of a block, the standing of vehicles should be prohibited for the length of this constriction. Stopping should also be prohibited during the time that a street is artificially constricted by construction work. In this manner the street will retain as much traffic capacity through its narrower portion as it possesses at other places where parking is permitted.

[1] YOUNG, HUGH E., Engineer, Chicago Plan Commission, *New Jersey State League of Municipalities, Special Report*, 99. "A city thoroughfare is not a parking or storage yard. It is a public highway. The interests and convenience of automobile owners must give way to public necessity. The parking or storing of vehicles on any street when they interfere with moving traffic should not be tolerated."

Secondly, parking of all kinds, and especially *dead* parking should be prohibited at all places where the presence of standing cars will interfere with the movement of fire apparatus. In Boston the standing vehicle, together with the density of moving traffic results in unnecessary delays averaging from 3 to 7 minutes per piece of fire apparatus, so the writer is informed by the chief of the department. The fire hazard created by such obstructions can readily be realized. One of the most reasonable regulations for remedying this situation is that used by the city of Detroit. Any street which is designated by the Commissioner of Police—by rule, upon certification to him by the Board of Fire Commissioners—as a street normally used by fire apparatus in attending fires, is known as a fire route.[1] Upon such routes the parking of vehicles is unconditionally prohibited.[2] The provision contained in practically all traffic ordinances that vehicles shall not park close to fire hydrants is one which deserves more rigid enforcement than it usually receives. A careful study of the relation of the parked car to fire hazards in New York State led a special committee of fire chiefs to advance the following recommendations:[3]

1. Prohibition of *dead parking* in all alleys and streets in the central portion of cities is the ultimate and logical remedy.

2. Where parking is permitted prohibition should be placed upon double line parking, parking nearer than 20 feet to a fire hydrant, parking in alleys, locking parked cars, parking within 600 feet of a fire.[4]

In addition to the above, stopping should be prohibited in the space between safety zones and the curbing, and for a distance toward the middle of the block sufficient to permit movement between the front of the first parked car and the rear of the safety zone, of the number of lanes of traffic which can be accommodated in the roadway between the zone and the curbing.

[1] *Detroit Street Traffic Ordinance*, part 1, sec. 4, 2nd ed., 1920.

[2] *Ibid.*, part 1, sec. 6.

[3] *New York State Bureau of Municipal Information Report* 975, Albany, N. Y., 1924. "City Regulations to Eliminate Fire Hazards from the Parking of Automobiles in Streets and Alleys."

[4] *Los Angeles Ordinance:* "It shall be unlawful for the operator of any vehicle other than a fire, police, ambulance, or public utility emergency vehicle, to follow any fire apparatus closer than one block, or to park any vehicle within the block where fire apparatus has stopped in answering an alarm."

Thus the Los Angeles ordinance prohibits stopping—"within 20 feet of a point on the curb immediately opposite the mid-block end of any safety zone."

Parking should not be permitted in such close proximity to a turn in the street or an intersection as to restrict unduly the movement of turning vehicles.

The Effect of Parking Prohibitions on Business.—The proposal for widespread parking prohibitions always brings to the front the question of the effect of such regulations upon business. Several cities have attempted to prohibit parking in considerable portions of their congested districts. Merchants have in all cases offered objections to the enforcement of such rules when first established. The writer was informed by the head of the merchants' association in one of these cities that the gross sales during the days when parking was prohibited, were reduced to 60 per cent of normal. It was estimated that the ultimate effect of the regulation would be a reduction of gross sales to approximately 90 per cent of normal.

The number of customers who come to a place of business in motor cars which they leave standing on the street, varies from city to city, and according to the type of business. The shops which cater to the poorer classes of the public would not be affected perceptibly by the regulation, as their customers normally do not come in automobiles. The shops with exclusive clients would likewise feel the regulation but slightly, for their patrons chiefly use chauffeur driven cars, which can deposit their passengers and proceed to a place where parking is permitted.

The extent to which shops whose patrons drive their own cars would suffer, will depend largely upon the presence of parking spaces in close proximity to the prohibited area in which the business is located, and upon the availability and attractiveness of other means of transportation, such as busses and trolleys. Even where conditions are most favorable it is probable that some people will be inclined to stop patronizing stores located in the district where parking is prohibited. This should cause cities contemplating parking prohibitions to proceed cautiously, and gradually, in order that alternative parking provisions can be made. However, considering the present difficulty in finding available parking spaces, the adequacy of rail and bus transportation in most cities, and the serious effect which parking has on the essential movements of commodities and passengers

in the congested district, the plea of the merchant that a prohibition of parking will work his ruin is not to be taken too seriously. That part of the business of the city which is lost to the downtown merchant, will not in any case be lost to the city as a whole, but will be absorbed by the neighborhood stores in the outlying business districts, and will thus work for a desirable deconcentration of urban interests.

What Will Become of the Automobiles When Parking Is Prohibited.—Where parking is prohibited another question naturally arises: What will become of all the cars that are now parked on the city streets? The answer is twofold. Those owners who feel that under the changed conditions, it is not worth while to use their automobiles in the city, will resort to some other means of transportation. This may seem to be an undue hardship, but it should be noted that thousands of motorists in every large city have not been using their motors for personal transportation for a number of years, due to congestion which has resulted to no small extent because a relatively few individuals have demanded a right to store their cars upon the public streets.

Those owners, for whom the automobile still possesses utility, even though they must pay for its storage, will continue to bring it into the prohibited parking area as before. After all the ability of a transportation vehicle to bear terminal charges at both ends of the run, is not a very severe test of its utility. If a private passenger automobile is not worth enough to its owner to justify his paying 25 to 50 cents a day for its storage, it does not seem reasonable that the public should provide him with improved street space for the purpose.[1] It is not impossible that prohibited parking may not only work for a desirable release of storage space for moving traffic, but that it may bring about a restriction of the amount of traffic on the city streets by weeding out those vehicles which have no real business in the area.

Alternative Provisions for Automobile Storage.—Assuming that a large number of persons will continue to use their cars on busy streets, and will be willing to pay for their storage, will it be possible for them to find adequate and convenient storage space? In many cities at the present time there is unused public property

[1] CHAPMAN, ELWOOD B., *Engineers and Engineering*, p. 82, Mar., 1923. "A parking survey in Philadelphia revealed cars parked from 30 minutes to 9 hours. One of the 9-hour cars was occupying a piece of street having an assessed valuation of $30,000."

which can be utilized for parking spaces. In Cleveland a public square was converted into a storage space with a nominal rental charge. The square is constantly filled with standing cars, and the city gains a considerable revenue from the service. In Chicago a portion of Grant Park, between Michigan Avenue and the Lake has been used for a similar purpose. This public parking area has a capacity for approximately 3,000 cars, and in fair weather is generally filled. A fee of 25 cents is charged.

FIG. 19.—A hillside garage, Los Angeles.

An ingenious checking system makes it possible to protect the cars from being stolen. A city which has such vacant land in the congested district may, of course, open it freely to the public, but it seems only reasonable that when a special service of this kind is rendered to individuals that the city should collect at least a nominal fee.

In various cities where there are park areas in the congested district it has been suggested that excavations be made and that subterranean storage spaces be provided. The cost of the

undertaking has kept the proposal from gaining great popularity.

It is probable that the chief supply of parking spaces will come from private individuals. Los Angeles affords excellent examples of the use of vacant lots for automobile storage. A fee of from 25 to 50 cents a day is charged according to the location of the space, and the several score of such open-air garages in the business district are usually filled to capacity.

The privately owned downtown garage also offers relief. Thus far these have generally been considered a rather speculative venture, and it is understood that financial interests have been hesitant in backing such structures. Moreover, in some cities

Fig. 20.—Parking plaza, Automobile Club of Southern California.

the zoning laws at present make such buildings impossible. Where such garages have been built (in Los Angeles and Boston, for example) there appears to be no difficulty in keeping them filled to capacity. With growing restrictions upon street parking privileges it is reasonable to suppose that the increased demand for storage space will warrant the construction of this type of building. With adequate building laws there seems to be no reason why downtown garages should either add to the fire hazard, or detract from the appearance of the district.

Storage space as an integral part of business buildings is another way in which future demand can be met. In Los

Angeles the University Club, which is located in the business district, has provided a garage as a part of the new club building. In the same city several large office buildings have been so constructed that the basement and sub-basement afford standing room for the cars belonging to the occupants. The use of roofs for the storage of cars has been advocated, but with one or two exceptions, (New York and Los Angeles) the plan has not been widely used.

Limited Parking Regulations.—The obstacles placed in the way of prohibited parking legislation have led most cities to satisfy themselves with limited parking rules.

PARKING RESTRICTIONS IN TYPICAL CITIES

City	Prohibited parking in certain areas	15-minute zone	30-minute zone	40-minute zone	1-hour zone
Boston	..	..	X	..	X
Buffalo	X	..	..	..	X
Chicago	X	..	X		
Cleveland	X	..	..	..	X
Kansas City	X	..	..	..	X
New Orleans	X	X	..	..	X
Philadelphia	X	..	..	..	X
Portland, Ore	X	X	X		
St. Louis	..	X			
San Francisco	..	..	..	X	
Seattle	X	..	..	..	X
Washington, D. C	X	..	..	..	X

A questionnaire sent by the Bureau of Municipal Information of the New Jersey State League of Municipalities (*Special Report* 99) to 253 cities, revealed the fact that 17 cities place no limitation on parking; 29 provide that on certain streets stops shall be made only to receive or discharge passengers; 1 has a 10-minute parking area; 9 have limitations of from 15 to 20 minutes; 22 have ½-hour zones; 8 have zones with limits of from 40 to 45 minutes; 25 have 1-hour zones, and 9 have limits ranging from 1 to 2 hours.

On the surface time regulation seems very desirable, and in the absence of the actual prohibition of parking, is effective, for

it makes it possible for the police to reach the owner who brings his car into the city in the morning and leaves it standing during the entire day. The regulation has serious drawbacks. In no city has it been found possible strictly to enforce limited parking. The driver who habitually leaves his car in the same location for long periods of time is not so difficult to reach, but there are thousands of milder violators of the regulations who cannot be caught. Several police departments have detailed a number of officers from the traffic squad to enforce the limited parking ordinance, but in most cases the departments are so undermanned that officers cannot be spared for this duty. Indeed if an attempt were made strictly to enforce the parking regulations, it is doubtful if the entire police force of the average city would be adequate for the purpose.[1]

The rigid enforcement, moreover, of 15- or 30-minute rules would probably work as an actual handicap to traffic movement. Considerable maneuvering is required both to enter and leave a space, and this not infrequently interferes with vehicles passing on the street. A 100 per cent turnover every 15 minutes or ½ hour would result in almost constant obstruction to cars moving along the street. In those cities where the police are known to be watching for violators owners not infrequently evade the law by moving their cars a few feet before the expiration of the period which they are allowed to stand.

Detroit has developed an effective method for dealing with violators of parking regulations, and one which is quite as useful under prohibited, as under a time limit, ordinance. Whenever a vehicle is found illegally parked it is towed to a *vehicle pound*, from which it can be released by the owner upon the payment of $1 for the first offense, $3 for the second, and $5 for the third.[2]

Regulation of the Position of Standing Vehicles.—On those streets where it appears that the standing of vehicles will not interfere with traffic movement, provisions should be made for *ranking* or *parking*, and the public should be informed as to the

[1] CHAPMAN, ELWOOD B., *Engineers and Engineering*, p. 82, Mar., 1923, referring to Philadelphia; "We found that it was absolutely impossible to enforce a parking limit no matter what it was—even if as short as 15 minutes unless an officer or possibly two were to be placed in each block and time each car. We came to the conclusion that the only successful way was to prohibit parking altogether."

[2] *Detroit Street Traffic Ordinance*, part 3, sec. 2, 2nd ed., 1920.

manner in which their cars shall be left. Where individuals are permitted to leave their cars in any position which they desire, the available spaces are not utilized to the fullest extent, and the streets are obstructed. The ordinances of practically all cities require as a general regulation that cars shall be parked parallel with, and as close to, the curbing as possible, some specifying that the wheels of the car shall be within 1 foot of the curb. This plan has the disadvantage of making it difficult for drivers to enter and leave spaces which are often scarcely longer than the car itself. One city has remedied this defect by painting dividing lines at right angles to the curbing, designating the space which shall be allowed to each vehicle, and allowing sufficient room for maneuvering. The chief disadvantage of parking parallel to curbing, however, is that a smaller number of standing cars can be accommodated by this method. This has led many cities to permit angle parking, that is, the standing of cars side-by-side at an angle to the curbing. In this manner a much larger number of vehicles can be accommodated in a given street length. On many thoroughfares, however, the practice has serious results. Angle parking should not be permitted unless the street is sufficiently wide to permit the free movement of one line of traffic in each direction, in addition to the space occupied by the standing cars. And on streets containing street car lines, this type of ranking should not be allowed unless there is room between the space occupied by the ranked cars, and the car tracks for a moving line of traffic. In many cities angle parking has been the cause of serious delays, to both vehicular and rail traffic. Where angle parking is permitted, drivers should be required to enter the stall by driving directly into it, instead of backing in. In this manner less delays are caused, for the vehicle can be backed out of the stall at a time when it does not interfere with traffic, which is not always the case when the vehicle must be backed in.

Vehicles should never be permitted to stand at an angle greater than 45 degrees, except in traffic squares and in other places where traffic does not move in close proximity to the parking area. Where right angle parking is permitted, the cars in entering and leaving the stalls are placed in such a position in the roadway that their full length serves as an obstruction. Paint lines should be placed on the street surface so that drivers will know what type of parking is required, and so that neither too great

crowding, or waste of street space will result. The general practice is to allow a stall width of 9 feet, which permits 2 feet or more between each standing car for the use of passengers, and for maneuvering in entering and leaving.

For streets with heavy gradients angle parking has a special advantage in giving greater safety. Cars left parallel to the curbing on such streets are in danger of breaking away if the brakes are tampered with, while if the cars be placed at an angle the curbing serves as an effective stop. Where the right side of the street is the up-grade side, cars should be required to back into their stalls.

Parking in the street center has been used by a number of cities. Where the street is unusually wide, and sufficient space for moving traffic can still be had in addition to the space taken by standing cars at the curb and by those in the center of the street, the plan may be desirable. Wherever such room does not exist and there is merely a question as to the choice between curb and center street parking, the former is the more desirable. When cars are left in the street center, the occupants must cross a moving line of traffic in order to reach the sidewalk, and they tend to do this without reference to the regular crosswalks. Even though the curb is not used for parked vehicles it is difficult to prohibit its use to loading and unloading cars, and thus a condition not unlike double parking is created.

In every city there are occasional irregularities in the street plan, which form what may be compared with back eddies in a stream—portions of the street surface which are not normally used by moving traffic because they are off the straight line of travel. Where such spaces are not needed by pedestrians as a safety zone, or for loading vehicles, they can be used with profit for standing vehicles without inconvenience to moving traffic. Painted stalls should indicate the limits which may be utilized by standing vehicles in these places as well as in other locations.

Regulation of Loading and Unloading Vehicles.—As has been pointed out previously, of all the classes of standing vehicles, those which are standing at the curb for the actual purpose of taking up or letting down passengers, or transferring goods, should be given the greatest preference, for such vehicles are performing a task directly connected with transportation. This preference, however, should not be extended without restrictions which will insure the performance of the task in such

a manner as least seriously to inconvenience traffic which desires to move along the thoroughfare.

There are certain places where even the stopping of vehicles should be prohibited. Such places, for example, are the areas between safety zones and the curbing, and the approaches to bridges. Even though it may be greatly to the convenience of a driver to unload his truck at a given place the privilege should be prohibited if the place is such that moving traffic will be inconvenienced.

Where stopping for the purpose of loading and unloading is permitted it should be subject to rigid regulations. A rule which has been proposed in many cities, but which has never gained wide acceptance is one which limits the hours for deliveries in the congested districts. It is anticipated that in this manner the obstruction to traffic during the rush hours offered by the vehicles standing for loading will be lessened, and also that the actual number of commerical cars in the congested district will be lessened during the periods when the streets are most needed for other traffic. Notwithstanding the value which the regulation would have in the relief of traffic congestion it has met with the protests of the trucking interests and the merchants of the business area wherever it has been proposed. The former claim that terminal conditions are such that the goods must be removed at definite times, and that to prohibit immediate delivery would necessitate a double carriage, one to the warehouse, and the second from there to the destination during the hours when deliveries are permitted. The merchants claim that certain kinds of business must be expedited as much as possible, and that a delay in the receipt or delivery of goods would cause a hardship. There is much merit in these claims, and they should be carefully considered in contemplating regulations limiting delivery hours.

A number of cities have been able, however, to limit the time for deliveries of certain classes of goods. Thus, in Boston the delivery of coal, ice, barrels, or kegs, is prohibited between the hours of 9 a. m. and 5 p. m. on eleven streets in the congested district.[1]

Where loading and unloading is permitted the question arises as to the manner in which the act should be carried out. From the standpoint of the driver of the truck the most convenient

[1] *Street Traffic Regulations*, Art. 8, sec. 1, Boston, 1921.

way is to back the truck to the curb and pass the goods over the rear end.[1] In this way, however, the length of the truck projects into the street and causes much more obstruction to passing traffic than if the vehicle were standing parallel to the curbing. Considering this type of obstruction several cities have forbidden backing to the curbing. Thus in Los Angeles it is provided that:

> Between the hours of 7:00 a. m. and 6:00 p. m. of any day no vehicle shall be backed to the curb in any part of the Central Traffic District, nor in any business district, except where provision has been made for angle parking.

In Cleveland a similar provision is made for twenty-one streets in the business district.[2] The Detroit ordinance makes a similar provision, but with the qualification that when unloading from the side:

> . . . is impractical because of the size or weight of the package, the vehicle may back to the curb but shall not stand at an angle which will interfere with the operation of street cars or other vehicles.[3]

In Baltimore the movement of traffic is protected from loading vehicles by a unique regulation which provides that:

> It shall be lawful for the owner or occupant of any store, warehouse, or building in any street or avenue in which the rails of any railroad company are laid so close to the curb-stones as to prevent the owners or occupants from keeping any such cart or other vehicle in the carriageway in front of his place of business without interference with the passing cars of any such railway company, to occupy . . . during business hours so much of the sidewalk as may be necessary . . . provided that a sufficient space be retained for the passage of pedestrians between the cart or other vehicle . . .. and the front of every such store, warehouse, or other building.[4]

This is a regulation which is not apt to be copied widely.

In Boston one finds the surprising permission to drivers of loading vehicles to back to the curbing between the hours of

[1] Borough President JULIUS MILLER, *Annual Report of the Borough of Manhattan*, p. 14, New York, 1923, in commenting on this practice says: "The backing of vehicles against the curb in loading and unloading seriously obstructs the roadway to passing vehicles. Vehicles should be so constructed that they can be loaded and unloaded from alongside the curb."

[2] *Cleveland Traffic Code*, sec. 2257, 1922.

[3] *Detroit Street Traffic Ordinance*, part 2, sec. 30, 2nd ed., 1920.

[4] *Baltimore Traffic Regulations*, sec. 9, 1917.

6 o'clock p. m. and 6 o'clock a. m. *and to block surface cars for a period not to exceed* 10-*minutes at one time.*[1] In many other cities one finds explicit permission for vehicles to back to the curb to discharge or load goods, though usually with the general qualification that the position of the vehicle shall not unduly obstruct traffic.

Granting the importance of transferring goods and passengers from standing vehicles, the permission to back to the curbing on busy streets seems unreasonable. The added convenience to the truckers does not outweigh the inconvenience caused to the

FIG. 21.—Traffic obstruction by truck backed to curb.

general public, and this method of loading should be strictly prohibited in congested districts.

Several cities have adopted provisions for facilitating the business of the loading vehicle where general parking is permitted. The recently adopted Los Angeles code provides that:

> It shall be unlawful for the operator of any vehicle to stop said vehicle for a period of time longer than is necessary for the loading and unloading of passengers or materials, provided that the loading or unloading of passengers shall not consume more than 3 minutes, nor the loading or unloading of materials more than 20 minutes . . . in any loading zone.

[1] *Street Traffic Regulations*, art. 4, sec. 2, 1920.

The Board of Police Commissioners is authorized to reserve one-half of the total curb length for loading zones in any block where the distance between the curb line and the center of the roadway, or between the curb line and the nearest rail of any street car track is less than 15 feet. In other blocks where the roadway is wider, one-fourth of the total curb length may be reserved for loading zones.

The ultimate solution of the loading vehicle problem is the establishment of loading places within building lines. In the final analysis merchants have no right to use spaces at the curb and on the sidewalk for the handling of goods when these spaces are in demand by the public for purposes of travel. In a number of cities recently constructed buildings indicate the tendency toward making interior provision for loading. The additional facility with which such transfers can be made within the buildings, and the release of street and sidewalk space for potential customers should, to a large degree, compensate the occupants of buildings for the cost of interior drives and loading platforms.

CHAPTER X

REGULATION OF PEDESTRIANS AND DRIVERS

Those who walk in a city street are as much a part of the traffic stream as those who ride. Traffic regulations which fail to make provision for the free and safe movement of pedestrians cannot be considered satisfactory. In no phase of street traffic regulation have cities made less progress than in their methods of handling the walker. Since the advent of the motor car the greater part of the attention of public officials has been turned toward making ordinances restricting and directing its use.

The problem of pedestrian regulation has two aspects: first, how shall pedestrians be regulated so that the sidewalk may be freed from congestion; and second, how shall pedestrians be regulated so that obstructions and hazards in the roadway may be lessened?

The Growing Demand for Sidewalk Space.—The first aspect of the problem presents many complexities. The concentration of business interests in relatively small areas of cities has resulted in a demand for sidewalk space bringing about a congestion in that part of the street, no less critical nor threatening than that which exists in the roadway. Buildings along city streets have moved up from three to thirty stories, serving as magnets to draw thousands through their portals where formerly people entered only by tens and scores. Demand for sidewalk space is required not only for those going to and from their work in the office buildings, but also for the swarms of people who are attracted to the display windows and counters of the great department stores.

The following table shows the concentration of pedestrian traffic created by large buildings in Chicago. The count was taken by 15-minute periods during the evening rush.[1]

[1] Kelker, R. F., Jr., *Report and Recommendations on a Physical Plan for a United Transportation System for Chicago*, p. 43, Chicago, 1923.

Type	5:00–5:15 p.m.		5:15–5:30 p.m.		5:30–5:45 p.m.	
	Number	Per cent	Number	Per cent	Number	Per cent
Office buildings	21,860	57	11,940	43	11,080	39
Department stores	10,560	28	13,090	48	14,810	52
Public buildings	5,080	13	2,040	7	1,760	7
Hotels	640	2	560	2	590	2
Totals	38,140	100	27,630	100	28,240	100

It will be noted that the buildings counted not only throw out large numbers of people but that the outrush is of such a nature as to create a very heavy peak load on the streets. The office buildings, for example, pass out almost twice as many during the first 15-minute period, as in either of the subsequent periods.

A recent check in the city of Los Angeles reveals the fact that 504,000 persons passed through the intersection of Seventh and Broadway during a normal business day. Of these 200,000 were street car passengers, 35,000 were occupants of automobiles, and 270,000 were pedestrians.[1]

Although the demand for sidewalk space has increased by leaps and bounds and is still increasing, there has been little or no increase in sidewalk capacity. The result is that in practically every large city the rush hours, morning, noon and evening, find the walks in a condition of almost complete saturation. When this condition is reached the pedestrians who are in greater haste than their fellows take to the street with the result that vehicular traffic is retarded and serious hazards are created. The provision of additional sidewalk space through the construction of underground passage ways, and overhead sidewalks and arcades, has been previously discussed.[2]

[1] Traffic counts at other famous intersections show the following conditions:

Hyde Park corner, London	478,000
Fifth Avenue and Forty-second Street, N. Y.	460,000
Times Square, N. Y.	447,500
Columbus Circle, N. Y.	395,000
Place de l'Opera, Paris	384,000

[2] See Chap. VI.

How Wide Should Sidewalks Be?—The solution of the problem as to how much of the street surface should be given over to the use of pedestrians is difficult to determine and varies according to the type of business carried on in a particular district. It is believed that for retail districts the following conclusions of the engineers of the City Planning Board of St. Paul, are adequate:

> The width of sidewalks in a strictly retail section must be such as to accommodate the pedestrians doing business at the stores whether the street is local in its roadway character or of the through type. There is, in other words, no close relation between sidewalk widths and roadway widths in a business district. Their functions are different and the required capacity of the one has little bearing on the required capacity of the other. In the same way that the corridors and lobbies in buildings and aisles in theaters are gauged in area and width to accommodate the number of people who may be required to use them, so sidewalks must be harmonized with the floor area of abutting shops.
>
> Sidewalk capacity for general use is inflexible. In this respect they are unlike roadways whose capacities change with every change in the type of transportation.
>
> A general statement of the proper relation is that the sidewalk area should not be less than one-twenty-fifth of the total built-up floor space in a retail and office district, but that it should not be smaller in any case than one-fifth of the ground floor building space.[1]

The ultimate solution for the problem of sidewalk congestion undoubtedly lies in a reestablishment of the proper balance, between the supply of sidewalk space and the pedestrian demand either through an increase of the former or a decrease of the latter. The difficulties of street widenings, especially in the built-up business districts where they are most needed, have been pointed out, and it is probable that relief for sidewalk congestion from this source cannot be anticipated by most cities in the near future. In the meantime methods for the regulation of pedestrian traffic so that the present sidewalks may be used to their fullest capacity must be designed and enforced.

THE REGULATION OF PEDESTRIANS ON THE SIDEWALK

If vehicles were to use the roadway in the same haphazard manner in which pedestrians pass along the sidewalks, the death rate of the city would soar, and chaos on the streets would result. If pedestrians could be forced to obey the most fundamental

[1] City Planning Board, *Plan of St. Paul*, p. 35, 1922.

law of the road—*keep to the right*—much confusion would be eliminated, and the streams of sidewalk traffic would flow with comparative smoothness and rapidity. At present, no matter in what direction a walker is going on a busy sidewalk, or in what part of the walkway he is attempting to move, his progress is a series of conflicts with on-coming pedestrians. A number of cities have attempted to enforce the *keep to the right* rule but with little success, because the attempts have usually been sporadic and of short duration. Wherever attempts have been made to enforce such regulations through the directions of police officers citizens have revolted at what they consider an improper invasion of their personal liberties and the public press has assisted them by attacking the enforcement. Improved conditions, it appears, must come from a realization on the part of the public that its own interest lies in maintaining as orderly a movement on the sidewalk as that which exists in the street. In some cities it has been proposed that paint lines should be placed in the center of the sidewalk, with signs urging pedestrians to keep to their own side.

Cities may learn valuable lessons from their experience in regulating vehicles on the streets. Pedestrians should not be allowed to stop in congested sidewalks except along the building or curb lines. The walking of more than two abreast may with reason be prohibited, as it is in some cities. Loitering in the part of the walkway needed by walkers, and especially at entrances to stores, buildings, and places of amusement should be forbidden. Regulations similar to these have been strictly enforced on Fifth Avenue with very beneficial results in lessening the noon-hour congestion.

Jay-walking.—Improper and irregular movement by pedestrians on the sidewalk is sufficiently serious in its effects to warrant consideration, but it results in even more serious effects where the pedestrians mingle with the vehicular traffic either at the regular intersections or in mid-block. Traffic is delayed to an appreciable extent, and the accident and death statistics attest to the hazards created. Eventually it is to be anticipated that physical barriers will be erected which will make it as difficult for pedestrians to enter the roadway, as the curbing now makes it for vehicles to enter the sidewalk space. When such provisions are made, as great benefits may be expected as were brought about when railroad rights-of-way were fenced against trespassers.

The constant stream of pedestrians which now crosses streets at other places than at the established crosswalks is one of the most fertile causes of accidents, and retardation of traffic. Counts in various cities throughout the country result in the conclusion that the number of jay-walkers per block in the average busy retail districts is rarely less than 1,000 per hour. Where anti-jay-walking regulations have been enforced for short periods it is estimated that the capacity of the streets has been increased from 15 to 25 per cent, and that accidents have similarly decreased.[1]

The law has, in general, protected the person who puts himself and others in danger, and obstructs the movement of traffic on the streets, by crossing at mid-block. The rule differs from that applied to vehicles. In the case where a motorist injured a pedestrian by driving his automobile along a sidewalk the position of the car has been taken as a presumption of negligent or reckless operation. However, the fact that a pedestrian is in the roadway when he is injured does not place on him any special burden of proof. The driver and the walker have been held in the absence of laws to the contrary to have completely equal rights in the roadway. The rule is well expressed as follows:

> All persons have a right to walk in a public highway as well as to ride or drive upon it; their rights are equal, and both footmen and drivers are required to exercise such care and prudence as the circumstances demand. The fact that a footman undertakes to cross a street at a place other than a regular crossing for footmen will not, of itself, defeat an action against a horseman who negligently injures him by recklessly riding or driving against him.[2]

Even where city ordinances have specifically given the right-of-way to vehicles over pedestrians between intersections, it

[1] *Report of Committee on Traffic Control*, appointed by the Secretary of Commerce, p. 10, Washington, 1924. "In cities pedestrians should be instructed and urged to keep within the boundaries of designated safety zones and crossing places, and when there is congestion, to cross only with traffic. Motorists should be required to accord pedestrians safe and dignified use of such safety zones and crossing places." Beginning Jan. 24, 1925 a regulation prohibiting jay-walking and requiring pedestrians to move with traffic signals, has been strictly enforced by the police of the City of Los Angeles. The regulation has resulted in a reduction of accidents to pedestrians, of approximately 25 per cent, and in an increase in traffic flow of approximately 50 per cent.

[2] ELLIOTT, "Roads and Streets," p. 625.

has been held that the provision merely increased the amount of care which the pedestrian should exercise.

However, the power of municipal corporations to designate different portions of the streets for the use of footmen and vehicles has been sustained.[1]

A consideration of the existing law makes it seem desirable that a change should be brought about so that pedestrians in the street at places other than those where there are regular crosswalks, will have no more rights than the driver of a vehicle at present possesses when he drives his car into the part of the street designated as the sidewalk area. This may appear to work an undue deprivation of the rights of footmen to use the street surface, but when the danger in the roadway created by modern motor traffic is considered, the additional safety enjoyed by the pedestrian more than overbalances any inconvenience.

A number of cities have passed ordinances regulating the manner in which pedestrians shall cross roadways. The following table indicates the character of these regulations:

PEDESTRIAN REGULATIONS

	Must cross at crossing	No diagonal crossing	Keep to right	Look before crossing	Obey officer
Birmingham	X	X	X	X	
Boston	X	X	X	X	
Buffalo	X	X		X	X
Cincinnati	X	X	X	..	X
Cleveland	X	X	X	X	X
Indianapolis	..	X	..	..	X
Lincoln	X				
Long Beach, Cal	X	X	..	X	X
Los Angeles	X	X	..	..	X
Milwaukee	..	X			
Portland, Ore	X	X	..	..	X
St. Louis	..	..	..	..	X
Salt Lake City	Pedestrians have right of way at all places.				
Springfield, Mass	X	X	..	X	X
Toledo	..	X	..	..	X
Washington, D. C	X	X	..	X	X
Wilmington, Del	X	X	..	..	X

[1] *Home Laundry Co., v. City of Louisville,* 187 S. S. 645; 168 Ky., 499.

One of the best designed groups of regulations for pedestrians is that which forms a part of the New Orleans Traffic Ordinance.

Pedestrians

Regulations.—The roadbeds of highways and streets are primarily intended for the use of vehicles, but pedestrians have a right to cross them. By observing the following rules pedestrians will facilitate the movement of traffic and minimize danger to themselves:

1. *Must Obey Traffic Signals.*—Pedestrians are required to comply with signs, semaphores, whistles, and other traffic signals. Pedestrians may signal intention to cross the street. When given this warning, approaching vehicles shall come to a stop and give pedestrians right-of-way.

2. *Have Right-of-way at Intersections.*—At street intersections not under police signal control, pedestrians shall have right-of-way over vehicles, provided pedestrians shall give warning of their intention to cross the street by holding up their hand in a manner to be plainly seen. This shall not entitle the pedestrian to enter or cross the intersection regardless of approaching traffic, but shall be interpreted to require vehicles to change their course, slow up, or stop to permit pedestrians to negotiate the crossing with safety.

3. *Vehicular Right-of-way.*—Vehicles shall have right-of-way over pedestrians between street intersections.

4. *Jay-walking Prohibited.*—Pedestrians shall cross streets only at right angles, and at street intersections, and shall not cross street intersections diagonally.

5. *Keep to Right in Sidewalks.*—Pedestrians shall keep to the right on all sidewalks.

6. *Do Not Stand in the Street.*—Pedestrians shall not remain standing on the street except in safety zone, and shall not stop or loiter on a street crossing.

7. *Look before Entering Street.*—(*a*) Pedestrians should look before stepping from the curb, first to the left, and then to the right, for vehicles. (*b*) Pedestrians shall not step into that portion of the street open to moving traffic at any point between intersections where their presence would be obscured from the vision of approaching traffic by a vehicle or other obstruction at the curb, except to board a street car, or to enter a safety zone, at right angles. (*c*) When alighting from street cars, pedestrians should be sure the way is clear before crossing behind the car.

8. *Wait on Sidewalks.*—Persons waiting for street cars shall not step into the street sooner, nor on leaving a car remain in the street longer, than is necessary.

9. *Hooking on Vehicles.*—No person riding on bicycles, roller skates, coasters or other vehicles propelled by feet shall attach themselves to moving vehicles on public thoroughfares.

The number of cities possessing pedestrian regulations would make it appear that much progress has been made in controlling pedestrian movement on the street. The list is misleading, however, for in few cities are these regulations strictly enforced. The police have rarely dared to breast the storm of public disapproval which has always arisen when arrests were made for violations. The general experience of enforcement officers, and their attitude toward the situation is well expressed by Lieutenant Martin A. Blecke, of the Traffic Division of the Police Department of Cleveland, Ohio:

> While some cities have taken definite steps in making arrests of pedestrians, not one city to my knowledge, has adhered to this policy for any continued period . . . My conscientious belief is that the police departments of all cities should start *now* to make arrests of pedestrians in all cases of flagrant violations. We must certainly begin somewhere to make arrests if we are ever to do our part toward law enforcement as a means of educating the walking public . . . I dare prophesy that arrests of pedestrians for traffic violations will be a common occurrence in the congested districts of all cities within a period of 5 years, for this must be the future policy of all police departments if they hope to obtain better results in pedestrian accidents reduction and in traffic conditions.[1]

Several cities have attempted to remedy conditions by stationing special officers at the more crowded intersections. The intersection of Ninth and Euclid Streets in Cleveland is an example of such control. Five officers are in charge of the intersection, one operates the semaphore which directs traffic, and the other four are stationed at each corner to keep pedestrians back until the vehicle stream starts flowing in their direction. At this intersection the control by officers is very effective, though no attempts are made to enforce the regulation by arrests. It has served not only to regularize movement at the single crossing where it is used, but it is noted that pedestrians are so educated that they use more care at other intersections in the congested area.

For the protection of school children at intersections the so-called *School Crossing Regulation* recently adopted by the city

[1] *National Safety News*, p. 11, January, 1923.

of Los Angeles has proved of great assistance. The police are required to mark with yellow paint, crosswalks in the vicinity of public schools, and warning arrows with the words *School Crossing* on the pavement a short distance from the crosswalks. The drivers of motor vehicles and the operators of street cars are required to approach such places with caution, and are prohibited from driving into the crosswalk when the right half is occupied by a pedestrian. The regulation is well obeyed by

FIG. 22.—Pedestrian regulation in Cleveland.

the driving public, and together with the educational program carried on in conjunction with it, has materially reduced the accidents to school children.

When simple and definite regulations have been established the next requirement for the reduction of conflicts between pedestrians and motor vehicles is a careful education of the public. To this end, the regulations should be printed and widely dis-

tributed signs should be erected at intervals in mid-block warning pedestrians not to cross; and above all clearly indicated crosswalks should be marked at intersections.

Crosswalks should be somewhat wider than the sidewalks, of which they are an extension, in as much as they must carry not only the normal flow from the sidewalk, but in addition those who have been waiting to cross. Where the crosswalk is too narrow there is a tendency for walkers to get out of limits and cut diagonally across the intersection. The crosswalks should be placed where possible, in the line which is naturally taken by crossing pedestrians. The lines should be repainted frequently for in this way the suggestion which they carry has greater authority. The present practice of two crowds of pedestrians rushing toward the center of the street, when they are released, and meeting head-on, can be overcome to some extent, by dividing the crosswalks into a right and left half. While vehicular traffic should be given the right-of-way in all other parts of the roadway, the regulation should place upon drivers the necessity for special caution in passing over such crosswalks. If the pedestrians are to be required to go to the corner to cross it is fair that those who obey should be given a special protection.

Intersection officers should be required to see that pedestrians waiting to cross the street have an equal chance with vehicles, but the foot passengers should be required, for their own safety and that of others, to cross only when traffic is moving in their direction. Where both pedestrian and wheel traffic is dense, a special time interval should be given for the crossing of pedestrians, and during this period the movement of vehicles in all directions should be halted. By this means both vehicular and pedestrian traffic movement are expedited, for all waiting footmen can be cleared from the crossing at one time.

REGULATION OF DRIVERS

Regulations concerning the registration and examination of drivers are usually matters left to the provisions of the state vehicle codes, but the provisions have a material bearing on the problem of city street traffic. A consideration of the actions which states have taken leaves one somewhat amazed that so little restriction has been placed on the drivers of motor cars.

In only fifteen states are owners driving their own cars required to obtain a driver's license, and in only thirty-four states are chauffers or paid drivers required to take out driver's licenses. In five States no age limit is fixed, and in others the lower limit is from fourteen to eighteen years.[1] The requirement that all who operate so potentially dangerous a vehicle as the modern motor car should be licensed and registered, is the first step toward gaining effective control over drivers and should be a part of every State vehicle code.

Age Limits for Drivers.—The question as to the age at which persons should be permitted to operate motor cars is one about which there is a great deal of conflicting opinion. That the very young, no matter what their mechanical ability may be, do not make good drivers because of their lack of judgment is generally admitted. It is the opinion of the writer substantiated by that of many traffic directors, that in the interests of public safety no person under eighteen years of age should be permitted to operate a motor car, and that no person should be given a license to act as a paid driver for passenger or commercial vehicles until he has attained an age of twenty-one years.

Drivers' Examinations.—Recently there has been considerable agitation for an examination of all who wish to become licensed drivers.[2] The fact that many drivers who have been involved in accidents have been found to be physically or mentally incapable of driving a car with safety, has led to the belief that no persons other than those who can show their ability by a suitable examination should be permitted to operate an automobile. The fact that many accidents result not from ignorance or inability, but from the viciousness or recklessness of experienced drivers, does not in the least invalidate the conclusion that all who are licensed to drive should prove their ability.

A reasonable examination, fairly given, would not keep anyone from driving a motor car who possesses the necessary qualifications for safe operation. An analysis of the qualities of a good

[1] GREEN, KANE S., "Traffic Regulations in Cities," *Engineers and Engineering*, p. 78, March, 1923.

[2] VOLLMER, AUGUST, Chief of Police, Los Angeles, "License and Registration," in *Transactions of the Commonwealth Club of California*, vol. 17, 12, p. 483, San Francisco, 1923. "Any individual can now get a license to operate a car in the State of California. It makes little difference whether he is deaf, dumb, blind, crazy, feebleminded, alcoholic, addicted to the use of drugs, or what not, they will grant a license upon application."

driver will indicate the minimum requirements which should be insisted upon.[1]

A good driver may be said to be one who has an ability to catch and correlate impressions which affect him, and who possesses such a skill and ability in the operation of his car, and such a knowledge of the traffic regulations that his reaction will be certain and in accordance with the law. There might be added to the requirements that he possess the will to act lawfully and in accordance with the rules of safety, but this is a characteristic which it is difficult to measure by a practical test.

The ability of an individual to catch impressions depends to a large degree upon the perfection of his eyes and ears, and of the two the former is by far the more important. Especially acute eyesight should be permitted to compensate a certain degree of deafness, but it is to be doubted if any person who has entirely lost his hearing should be permitted to operate a motor vehicle. The minimum perfection in eyesight which should be permitted is of course a matter of question, but there appears to be no reason why the requirements should not be as rigid as those imposed upon street car motormen. In Detroit applicants are required to have at least 25 per cent normal vision and hearing. A test for sight and hearing as well as for correlation of impressions has been designed for motormen, by the American Electrical Railway Association. It offers pertinent suggestions for the formulation of a motor vehicle drivers' test.[2]

Psychological testing has made considerable advancement in industrial work, and there is good reason to believe that this type of testing may offer the ultimate method for determining the fitness of persons to operate automobiles. Recently tests of this type were applied by Dr. A. J. Snow to the drivers of certain taxicab operators in Chicago. The drivers were rated

[1] *Report of Committee on Traffic Control*, appointed by the Secretary of Commerce, Washington, 1924. "There are three general requirements: First, that the applicant be mentally and physically qualified to operate a motor vehicle; second, that he shall know the laws governing the operation of a vehicle; and third, that he shall understand the operation of a motor vehicle and prove it by an actual test under conditions comparable to those he would naturally encounter on the streets and highways." The committee would also require the applicant to be sixteen years of age, and to possess an ability to read English.

[2] The test was prepared by Dr. John Leeming. See *Proceedings of the American Railway Association*, p. 339, 1922.

from three angles—intelligence, carefulness, and reaction to sudden danger.

The first test is much like that employed in the army. It is a written test designed to ascertain the applicant's power of attention, observation, memory, and ability to follow directions, etc. He is asked to divide lines into various portions; to look at a sheet full of different objects and describe them; to recognize opposites, and similar problems. The applicant does not need to be an intellectual heavyweight to pass these tests, but he must be able to carry out simple directions, recognize objects under unusual conditions, learn simple things, and have a normal memory. The moron or person of very low intelligence is quickly discovered and eliminated.

But intelligence is not the only qualification for a safe driver. A man may have a very alert mind and at the same time be habitually careless or reckless. These two failings are largely a matter of habit and training—or rather a lack of training. To test the driver's "bump of caution," he is taken into a room and told to handle certain objects and perform certain operations. The manner in which he follows directions and the time he takes to do it are carefully noted.

But even if a man is naturally careful he may lose his head when confronted with an emergency. To determine his presence of mind, he is told to operate an electrical board which may give him an unexpected scare. He is cautioned beforehand to shut off the switch and step on what corresponds to the brake of an automobile if anything unusual happens. The test is known as the "fear-time" reaction test. The driver's quickness and steadiness under this test gives an accurate estimate of his ability to meet the emergencies of modern street traffic.[1]

Experimentation has not been completed but the tests tally remarkably with accident records of the companies.

The motion picture affords the basis for what may prove to be a valuable method of testing. A strip of film taken from a machine driving along a typical street on which various types of conditions are arranged, is projected on a screen in front of the person being tested. The rapidity with which the film moves represents the speed of the cars, and the movement is controlled by the applicant by means of accelerators and brakes, similar to those in the car which is to be operated. A film properly taken will afford examples of situations which will test the reaction and ability of the applicant. Experiments with the film will indicate the maximum reaction periods which can be

[1] Snow, A. J., "Scientific Selection of Taxicab Drivers," *National Safety News*, pp. 5–6, July, 1924.

permitted with safety, and the record of the applicant's reactions can be compared with the standard, and a grade assigned. In this manner a standard examination could be given to a large number of applicants at the same time.

Any test of this kind, however, is merely a substitute for an actual driving examination. In Massachusetts every person who is given a license must show his ability by means of an actual road test. It is interesting to note that the licenses given are restricted; one is for the operator of planetary transmission cars, another for the operator of selective transmission automobiles, and yet others for steam and electric vehicles. A person who is not competent to operate every kind of a motor car may be restricted to the operation of a certain kind of machine and such restriction will be noted on his license.[1]

The New Jersey law provides that the commissioner shall grant a license after having examined the person and being satisfied of his or her ability as an operator, which examination shall include a test of the knowledge on the part of said person of such portions of the mechanism of motor vehicles as is necessary in order to insure the safe operation of a vehicle of the kind or kinds indicated by the applicant, and of the laws and ordinary usages of the road.[2]

In the District of Columbia it is required that the officer in charge of the Traffic Bureau of the Metropolitan Police Department shall cause all applicants to be examined as to their knowledge of the traffic regulations of the District of Columbia and ability to operate motor vehicles, and shall, if deemed necessary, require a practical demonstration as to ability to operate motor vehicles.[3]

While the law of Pennsylvania does not require an examination for drivers' licenses an attempt to bar the unfit is made by the following provisions:

Any person who has lost the use of one hand or both, or who has lost the use of both feet, or whose eyesight is so impaired that with the aid of glasses he cannot distinguish substantial objects clearly at a

[1] GOODWIN, FRANK A., Registrar of Motor Vehicles, "Things that Every Owner and Operator of Motor Vehicles Should Know," p. 9, Boston, 1922.

[2] *New Jersey, Motor Vehicle Act*, Compiled by WILLIAM M. DILL, Commissioner, sec. 8, 1922.

[3] *Regulations Relating to Street Traffic*, sec. 3, art. *a*, 1923.

distance of one hundred and fifty feet, or who shall have less than twenty per centum of normal vision, or who shall have less than two per centum of normal hearing, shall be considered physically incapacitated.[1]

The duty of making examinations of applicants for drivers' licenses may logically be assigned to the police authorities in each community, and compensation for additional services required paid out of the fee charged for the examination. This is the method followed in Michigan and while there is much lack of uniformity, and the examination has been perfunctory in many of the smaller communities, it has worked satisfactorily in the larger communities and especially in Detroit.

In this city a drivers' license bureau has been established under the direction of the Detroit Police Department's Traffic Division. An average of five men is at present employed for the purpose of examining applicants. They are usually members of the traffic squad who are recovering from wounds or accidents, and are unfit for outside work. The number of examiners is increased or decreased according to the number to be examined. The number of applicants averages about 300 a day throughout the year.

The examination which is entirely oral takes about 3 minutes. Notwithstanding its shortness, however, the severity of the examination is indicated by the fact that about 60 per cent of those examined are rejected because of lack of knowledge of the traffic ordinances. About 2 per cent are rejected for physical or mental defects. Applicants are required to pass an 80 per cent grade on the ordinance; to have 25 per cent normal vision; to have 25 per cent normal hearing; to be able to read traffic signs, and to be free from any disease that would prevent them from coordinating their minds and limbs. Failure in any one subject disqualifies the applicant though the defect may be removed and another test taken.

Commissioner Harry Jackson, under whose supervision the examination was worked out, informs the writer, that many of those who fail the examination attend public night school and learn to read; many have secured glasses and have passed the test for vision; and an average of 500 are enrolled in the police school for drivers. "This school was started," Commissioner Jackson says, "because tests that we have made reveal the facts

[1] *Motor Vehicle Laws*, Compiled by LEWIS S. SADDLER, State Highway Commissioner, sec. 10, 1920.

that the drivers of Detroit do not know more than 25 per cent of the traffic ordinances." In Michigan no licenses are granted to drivers by the Secretary of State except upon receipt of an application bearing the signature of the local examiner indicating that the applicant has successfully passed the examination.

In the District of Columbia prospective drivers are also examined by the Metropolitan Police. There are six officers assigned to examining duty, and the test which is usually oral takes approximately 30 minutes. During the fiscal year ending June 30, 1923, there were 26,605 applicants for drivers permits. Of this number 19,748 were approved, and 6,857 were disapproved because of their physical disability, or lack of knowledge of the regulations.

The actual effect of drivers' examinations in terms of increased safety on the streets, or in greater facility of traffic movement, is difficult to estimate. It seems reasonable to believe, however, that the weeding out of those who are clearly incapacitated because of physical or mental defects, or whose knowledge of the common rules and regulations of the road is lacking, should have beneficial effects.

Of the various types of examinations now given, the road test as administered in Massachusetts, is best designed to give a practical test of the applicant's ability. It tests all of the qualities which go to make up a good driver, and if given under proper conditions, should assure the community that those who are in competent will not be turned loose with a potentially dangerous vehicle on the city streets. Where the road test is required provision should be made for temporary or student licenses, which authorize one who has not taken the examination, to operate a motor car, when accompanied by, and under the supervision of, a licensed driver.

The revocation and suspension of licenses is second only in importance to the granting of licenses after a thorough examination. In most states this power is vested in the secretary of state or in the commissioner of motor vehicles, and in most cases, is exercised, if at all, upon recommendation from local police or judicial authorities. There appears to be no valid reason why the actual power to suspend or revoke should not be vested in the local police courts, to be exercised by them on their own motion in the cases which come before them, or upon petition from the police.

CHAPTER XI

THE MUNICIPAL TRAFFIC CODE

The power of the city has been brought to bear upon the traffic problem in a number of different ways: through laws passed by the legislative body of the municipality; through the actions of municipal administrative departments such as the Board of Street Commissioners, and the Board of Public Works; through the Police Department; and finally through the courts. The ultimate solution of the traffic problems depends to a large extent upon the ability of these various parts of the government to function wisely and in harmony with each other.

In no way does the municipality affect the traffic conditions on its streets in a more definite manner than through the exercise of its power to make ordinances concerning the use of public streets. City regulations for the control of street use are of great antiquity. In Rome, and probably in other large cities of the Empire, travel by carriage was restricted to a few persons of high rank, due to the narrowness and crookedness of the streets. And for the same reason the transportation of goods in wheeled vehicles through the streets was prohibited during the daylight hours.[1]

Street traffic regulations developed early in the United States. An ordinance in the city of Albany in 1669 provided as follows:

> It is proclaimed ye all Persons who enter ye City with slees and horses, horseback or otherwise, shall not ride faster than foot-tap throughout ye streets, upon penalty of three shillings for each offense.[2]

In most of the American cities the traffic codes are the result of the conditions which have grown up during the past 20 years. The increase in the number of automobiles on the city streets; the congestion resulting from their increased use; and the hazards created by the more speedy type of transportation,

[1] Encyclopedia Brittanica, vol. 5, p. 134, 9th ed.

[2] Goodrich, E. P., *Proceedings of Conference on City Planning*, p. 78, 1920.

rendered the former ordinances passed for the control of horse-drawn vehicles entirely inadequate, and new codes have been drafted.

THE LEGAL STATUS OF TRAFFIC ORDINANCES

The legal status of city traffic ordinances is of some interest. In its control of the streets the city gains its authority as in the case of its other powers, from the legislature of the state.

By virtue of delegated authority, the municipality may by ordinance *limit and restrict the speed* of vehicles in the streets of the municipality; may make other reasonable regulations as to the use of the streets and the avoidance of obstructions therein; may required vehicles using the streets *to be licensed;* and it may require that vehicles using the public streets, or waiting therein for passengers, shall obey the directions of the police officers stationed in the streets and public places. By virtue of the supervision and control of the streets vested by statute in a municipality, it has been held that it is within the power of the municipality to require that any vehicle carrying a heavy load *shall use a particular portion of the street,* or require vehicles carrying heavy loads *to use wide tires.*[1]

The municipal corporations, likewise, possess under a general grant of police power, authority to pass ordinances which may be necessary and reasonable to preserve the safety and comfort and convenience of its citizens.

Thus a city may, through the exercise of its police power, and in order to facilitate and make safer the movement of vehicles and pedestrians over its streets, impose restrictions upon the manner in which streets shall be used. The types of ordinances are as numerous and broad as conditions necessitate. What may at one time appear an unreasonable use of the police power will, under changed conditions, be upheld as reasonable. The growth of traffic congestion and danger has necessitated many types of ordinances which would not have been sanctioned as a valid exercise of the police power several decades ago. Thus the hours in which abutting owners may load and unload goods across the sidewalk in front of their property, have been limited; vehicles are forbidden to stand at the curbing for more than a specified period of time, and in crowded districts may be forbidden to stand at any time. Different streets have been subject

[1] Dillon, John F., "Commentaries on the Law of Municipal Corporations," vol. 3, sec. 1166, Boston, 5th ed., 5 vols., 1911.

to different rules. On some boulevards commercial vehicles cannot be driven, while on some streets traffic is permitted to move in but one direction. At certain intersections the general right of the citizen to use the public street is restricted by a prohibition making it impossible for him to turn either to the right or left out of the street he is traveling.

As traffic conditions become more pressing there is a tendency for municipal ordinances more and more to restrict the manner in which the citizen may use the street. An attempt on the part of the municipal authorities to protect the convenience and safety of the public is presumed to be a valid exercise of the police power vested in the city until the contrary has been shown. So long as a specific ordinance does not conflict with the general laws of the state, is not arbitrary or unreasonable in its provisions, does not make unwarranted discriminations, and does not unduly restrain trade, it will be upheld as valid.[1]

Unfortunately the power which cities possess to regulate traffic upon their streets has not been used wisely in all cases, or in such a manner as to expedite movement or reduce accidents. The problem has grown with such rapidity that it has been difficult for the laws to keep pace with the needs. The change in the character of traffic from horse to motor has brought special problems which are too frequently disregarded in the making of regulations.

The Failure of Regulations to Keep Pace with the Problem.— The relics of laws of the former horse-drawn period are still to be found in many communities, in such regulations as those which require that persons shall not drive over bridges at a rate of speed faster than a walk; which provide that the speed of vehicles in city streets shall not exceed 6 miles per hour; and which sanction the loading and unloading of vehicles in such a manner as to cause serious congestion under modern conditions of travel. The failure of the law to keep pace has generally resulted in violations by the public with the consent and assistance of the police officials, the latter being aware that a rigid enforcement would result in intolerable conditions. It has been observed, for example, on a thoroughfare where the police claim with pride that they are able to move vehicles with safety at a rate of speed from 25 to 30 miles per hour, that there

[1] MUNRO, WILLIAM BENNETT, "Municipal Government and Administration," vol. 1, pp. 210–213, 2 vols., New York, 1923.

are signs carrying the provision of an ordinance that no vehicle shall exceed 15 miles per hour. If the streets are to be used most effectively by motor traffic the ordinances must set forth provisions designed for present-day conditions. Moreover, it must be remembered that these conditions are not fixed, and that a revision of the code once every 10 years is not enough. Congestion shifts from place to place with the growth of the community and with changes in the habits of the public.

Lack of Uniformity.—The lack of uniformity in the regulations of various cities and states is a problem which must be faced in the near future.[1] The growth of interurban and interstate commercial and passenger motor travel makes it imperative that there be a reasonable harmony in the laws of various municipalities.[2] It is claimed, for example, in a number of large cities where death rates from motor accidents are especially heavy, that one of the chief causes is to be found in the large number of "foreign" motorists who do not understand the local regulations. Some of the diversity of existing regulations in different cities has been previously noted. Among seventeen cities whose regulations were considered regarding the proper action for a driver overtaking a street car, it was found that ten had different regulations, and that eight specified a different distance at which the motorist might approach the rear of the trolley without violating the law. Complete uniformity among all of the cities

[1] *The General Highway Traffic Act*, being a code of uniform traffic regulations for all cities and villages in the state, except New York City, became a law on May 25, 1917. It supersedes local ordinances, rules, and regulations. See *Report* 265 of the New York State Bureau of Information, Albany, N. Y., 1917; *Report* 315, Albany, N. Y., 1918, indicates universal approval of police officials with the working of the act.

[2] I doubt if there is a man living who has an intelligent understanding of the various vehicle ordinances in force in the numerous cities and towns of California, and I think it is admitted that it is a physical impossibility for any motorist in this state to drive from San Francisco to Los Angeles without violating dozens of laws in the various towns through which he passes. Not only are these ordinances in conflict with each other, and not only is there complete lack of uniformity in the control of motor traffic in the various towns through which one passes, but in many instances do we find ordinances in conflict with the motor vehicle laws of the state of California . . . The resulting confusion in the minds of the motoring public with respect to traffic laws and ordinances, is in the opinion of your section a large and important factor in the terrific loss of life and the enormous personal injury damage sustained by the public of this state.

of the country, or even among those of the same locality is not possible, for conditions in different cities vary. A standard speed limit of 15 miles per hour in the congested district, and 20 miles an hour in the residential district, might be satisfactory for the average city, but in others the regulations might create undue congestion on one hand, or hazards on the other.

The failure of the codes to include provision for important types of traffic movement is another general fault. Of nineteen of the largest cities of the country, three fail to provide for the manner in which vehicles shall load and unload at the curbing; five omit reference to the obligations and duties of pedestrians; and eight make no mention of double-parking.

Lack of Simplicity.—Too great detail is a fault which many codes possess, and is one which is especially undesirable when no index is provided so that the motorist can obtain the information which he desires. The length of the ordinances which the driver must peruse in order to discover his duties varies from the 4-page pamphlet prepared by the Police Department of New York City, to the 68-page booklet containing the ordinances governing street traffic in the city of New Orleans. The latter, however, is one of the best and most interesting codifications in the country.

Unnecessary legal verbiage, which is the relic of the days when the scriveners were paid by the line for their work, is an even more serious fault. The regulations must be set forth in language which the average driver is able to understand without too great effort. In case the legal forms require considerable complexity of statement, a simple digest of the ordinance should be prepared for the use of the public. As an example of the extent to which legal terminology can hide the facts the following may be cited:

> It shall be unlawful for any person to hitch or stand or to leave hitched or standing or to cause or permit to stand or to be left hitched or standing any animal, or to stand or leave standing or to cause or permit to stand or to be left standing any vehicle on the easterly side of Los Angeles Street between the intersection of the southerly line of Fifth Street with the easterly line of Los Angeles Street and a point 150 feet southerly therefrom measured at right angles . . .[1]

Regulations Based on Opinion.—The chief fault with existing traffic ordinances, however, lies not in their form or omissions,

[1] *Ordinance* 41,090, art. 3, sec. 29, city of Los Angeles.

but in the fact that in most cases they have been made on a basis of opinion, rather than on the basis of fact regarding actual needs. The common practice when a new code is to be developed, or changes made in the old, is to hold a public hearing at which all interested parties may appear. Such a practice may be highly desirable when a measure to be passed is one concerning political policy, but it has rarely assisted in the development of sound methods of traffic regulation. Special interests, street railway officials, merchants, automobile clubs, offer proposals which may or may not be for the general public interest, but at any rate are rarely, if ever, based on a careful study of the conditions to be regulated and the effects of the proposed rules. Should boards of directors of street railways attempt to formulate their traffic regulation in a similar manner it is probable that the systems would operate with much less efficiency than they do.

Should the Power to Make Regulations Be Surrendered by the Council?—This situation brings up the question as to whether it would not be more satisfactory for the councilmen to pass only a general ordinance, and permit it to be amplified and changed by rules and regulations of some administrative authority in the city. In New York and Detroit this plan has been followed, the power being placed in the hands of the Commissioner of Police. In these cities it has been highly successful: regulations are better designed to meet existing conditions, and it has been found that there is greater opportunity to adapt the rules to changing conditions. In Detroit the Commissioner is assisted by the Public Safety and Traffic Committee composed of forty members, some of whom are engineers with considerable traffic experience, and many of whom are experts in automotive transportation. Streets are considered, studies are made, statistics collected, and conclusions drawn regarding new rules or changes in the old.

The power which is delegated to the commissioner by the council does not give him authority to make rules concerning all traffic matters, but only over those subjects which are designated. The commissioner, moreover, is given entire power and responsibility to enforce the other provisions of the traffic code. The provisions of the law which regulate the powers and duties of the commissioner are as follows:

Section 5.—The commissioner shall enforce the provisions of this ordinance and the rules adopted by him hereunder. Subject to the

provisions hereof, it shall be the duty of the department to direct and control traffic of vehicles and pedestrians.

Section 6.—The Commissioner of Police shall have power, by rules adopted by him, to:

(*a*) Designate the streets or parts of streets upon which there shall be no parking of vehicles or upon which there shall be parking for a limited time.

(*b*) Exclude or restrict parking on designated streets during certain hours.

(*c*) Permit angle parking in designated places.

(*d*) Establish one-way streets.

(*e*) Cause limit lines to be marked upon pavements and sidewalks for the direction of pedestrians and others.

(*f*) Prohibit left-hand turns by vehicles at street corners designated.

(*g*) Establish fire routes.

The scope of the rules and the way in which they shall be promulgated is set forth in the following section:

Section 7.—Such rules may be applicable to the entire city or to particular districts or streets, as shall seem advisable to the commissioner. Any rule adopted by the commissioner may, at any time thereafter, be amended or repealed by him . . . Printed pamphlets containing all rules and amendments thereto shall be published from time to time by the commissioner for public distribution.

Section 8.—No rule adopted by the commissioner . . . shall become operative:

(*a*) Until it is included in the official list of rules and placed on file in the records of the department.

(*b*) Until one or more suitable and durable signs or standards, containing the substance of the particular rule, are placed upon or affixed to the street or place affected. The number of such signs shall depend upon the length of the street or the size of the area affected by such rule; but shall be in sufficient number to apprise an ordinarily observant person of the existence of the rule or regulation upon the street or in the district affected . . .

In order that the council may still have an effective check on regulations it is further provided:

Section 12.—Any rule adopted hereunder by the Commissioner may be superseded by resolution of the Common Council.

The Publication and Distribution of Traffic Regulations.—In order that the public may be kept constantly informed as to the regulations in force a revision and codification of the

ordinances and rules should be made at least annually. One of the greatest assistants toward the reduction of congestion and the elimination of hazards on the public streets is knowledge on the part of every driver of precisely what the law requires of him. This is fundamental to any attempt to obtain regular and safe movement of vehicles. It is true that before the court, ignorance is no excuse, but such ignorance may nevertheless result in unnecessary obstruction, or in death. Immoral actions and those which are generally classed as felonious, are usually recognized as such by the average citizen, but in the case of traffic regulation he has no sense of right and wrong to direct him. Whether the car from the right or the left is to have the right-of-way is a matter which cannot be judged by the individual from his moral precepts: he must know what provision has been made on the subject. It is surprising that some of the greatest of American cities, fail for long periods of time to supply citizens with copies of the traffic regulations, and that other cities have available only old copies which have become antiquated. Such a condition places an unnecessary burden on the police charged with the direction of traffic; makes many individuals innocent law-breakers, and creates serious hazards because some drivers act in one way and some in another.

Following is the digest of a traffic code recently prepared by the author for the city of Los Angeles. This synopsis is printed for wide public circulation on a four page cardboard folder. It is distributed through the police department, the automobile club and other agencies. The digest is included here because it illustrates a desirable simplicity in the statement of traffic rules, and because it exemplifies the practical application of many of the principles of control discussed in this and preceding chapters.

Definitions

Central Traffic District.—(See map.)

Business District.—Any block in which 50 per cent of the frontage is used for wholesale or retail business, and at the discretion of the police any block immediately adjacent.

Crosswalk.—Area included in extention of sidewalk lines at all intersections and elsewhere as marked by paint lines.

Safety Zone.—Portion of roadway, as marked at car stops and elsewhere, reserved for exclusive use of pedestrians.

Traffic Direction

Police Regulation.—Obey police directions and traffic signs and signals. Persons other than police are forbidden to direct traffic.

Signal Legend.—Red—Stop; Green—Go; Yellow or Bell—Do not enter intersection until released.

Pedestrian Protection and Regulation

Safety Zones.—Pedestrians have exclusive use of safety zones. Vehicles must not enter.

Crosswalks.—Pedestrians have right of way in crosswalks. When a pedestrian signals by holding hand palm out toward traffic, drivers must permit pedestrian to pass before entering crosswalk.

School Crossings.—Drivers are forbidden to enter yellow marked school crossings when right half is occupied by pedestrians.

Jay-walking.—Pedestrians must not walk in roadways other than at crosswalks if such action interferes with movement of vehicles. Pedestrians must cross roadways by the most direct route, and in the Central Traffic District and in Business Districts may cross only by crosswalks. Pedestrians must obey traffic signals.

Sidewalks.—Pedestrians when stopped on sidewalks must stand near the building or curb lines.

State Regulations

Accidents.—Drivers involved must stop, render aid, and give name and address. If person is injured report must be made to police.

Brakes must be in good condition. Must be set and engine stopped when vehicle is left unattended.

Curves.—On obstructed curves horn must be sounded. Overtaking is prohibited.

Fire and Police vehicles have right of way; others must draw to the curb and stop.

Following closer than 15 feet on open road prohibited. Truck with trailer must keep 100 feet behind another truck and trailer.

Lights must be shown from one-half hour after sunset to one-half hour before sunrise. Two head and one tail light required. Red light visible from front prohibited. Approved dimming device required. Tail light required on parked vehicles unless street has sufficient light to reveal objects 200 feet distant.

Luggage must not extend beyond hub cap line on left, nor more than 6 inches beyond hub cap line on right.

Mirrors required where driver's vision to rear is obstructed.

Mufflers must be used in business and residence districts.

Non-residents must register within ten days after arriving in State.

Number Plates must be kept cleaned and unobstructed.

Operator's Licenses must be carried by all drivers.

Overtaking prohibited within 300 feet of approaching vehicle unless overtaking vehicle can be kept on right half of roadway. Two feet clearance required and cutting in prohibited. Overtaking prohibited at intersections unless at direction of officer. Overtaken vehicles upon signal shall draw to right and not increase speed. Overtaking street cars to the left prohibited. *At all times drive as close to the right of the roadway as possible.*

Right of Way.—Vehicles on streets have right of way over those entering from private driveways. At intersections vehicles entering first at legal speed have right of way. When two enter at the same time vehicle from right has right of way.

Signals.—Starting, turning and stopping prohibited if dangerous. If others will be affected by movement signals as follows must be given. *Left Turn*—Extend arm horizontally beyond left side of vehicle; *Right Turn*—Extend arm upward beyond left side of vehicle; *Stop*—Extend arm downward beyond left side of vehicle. Right and left signals must be given continuously during last 50 feet before turning.

Speed.—Safe and prudent speed required at all times. 15 miles per hour maximum at obstructed crossings, on obstructed curves, when passing children leaving or entering schools, and in business districts. 20 miles per hour maximum in residence districts. 35 miles per hour maximum elsewhere.

Spot Lights must not be adjustable to throw a beam more than 42 inches above the roadway at a distance of 100 feet.

Turning.—Vehicles may be turned around only at intersections except in residence districts when no vehicle is approaching within 200 feet.

Tow Lines must not exceed 15 feet in length, and must have attached a red cloth at least one foot square.

City Regulations for Driving

Turning.—At intersections other than those in the Central Traffic District right turns may be made with or against signals, but at all places must be made from the line of traffic nearest the curb. Left turns may be made only from the line of traffic nearest the center of the roadway. Cutting corners is prohibited. Double left turns are prohibited in the Central Traffic District and in Business Districts between the hours of 7 a. m. and 6 p. m.

Left turns are prohibited from 7 a. m. to 6 p. m. in the following places:

Into or out of any alley in the Central Traffic District or Business District.

At the intersections of Hill Street and Sixth and Seventh Streets.

At the intersections of Broadway and Fifth, Sixth, and Seventh Streets.

At the intersections of Spring Street and Fifth, Sixth and Seventh Streets.

At the intersections of Main Street and Fifth, Sixth and Seventh Streets.

At the intersection of Los Angeles Street and Seventh Street.

One Way Alleys.—In any alley in or terminating in the Central Traffic District vehicles shall not be driven in a southerly or in an easterly direction.

Sidewalk Stops.—Vehicles must be stopped immediately before crossing the sidewalk when leaving any alley or driveway.

Limited Vehicles.—The following vehicles must not be operated in the Central Traffic District between the hours of 7 a. m. and 6 p. m.

Freight vehicles exceeding eight and one-half feet in width.

Freight vehicles with more than 20 feet of overhanging load.

Vehicles carrying building material which has not been loaded or is not to be unloaded in the district.

Freight vehicles with trailers.

Vehicles conveying crude oil.

Vehicles conveying refuse, rubbish or garbage.

Animal Drawn Vehicles must not enter the Central Traffic District between the hours of 4:30 p. m. and 6 p. m.

Loose Loads.—Vehicle loads must not be scattered on roadways.

Boulevard Right of Way.—Vehicles on the following streets have the right of way. All vehicles before entering such streets shall be brought to a full stop, except when traffic has been released by officer or signal.

Figueroa Street from Washington Boulevard southerly.

Whittier Boulevard from Boyle Street easterly.

Mission Road from the northerly line of Macy Street to Alhambra Avenue.

Sunset Boulevard from Figueroa Street westerly.

Wilshire Boulevard from Park View Street westerly.

Washington Boulevard from Figueroa Street westerly.

Vermont Avenue from Los Feliz Boulevard southerly.

Western Avenue from Los Feliz Boulevard southerly.

Fire Apparatus.—Vehicles must not follow fire apparatus closer than one block nor park in the block where fire apparatus has stopped in answering an alarm.

Funeral Processions have the right of way over other traffic.

Motorcycles and Bicycles.—Persons shall not be carried on the bar or tank of any motorcycle or bicycle. Motorcycles, bicycles and toy vehicles shall not be attached to moving vehicles or street cars.

Emergency Vehicles of the Police and Fire Departments, and of public utilities, while actually engaged in emergency business, are not subject to local traffic regulations.

Stopping, Standing, Parking

Standing Prohibited.—Vehicles shall not stand by curbs painted red.

Loading Zones.—Vehicles must not be stopped longer than is necessary to load and unload at curbs painted yellow. Three minutes maximum allowed for passengers and twenty minutes for merchandise.

Parking Prohibited.—Vehicles shall not be stopped longer than is necessary to load and unload at any place in the Central Traffic District between the hours of 4:30 p. m. and 6 p. m. Same limit as for loading zones.

Parking Limited.—Vehicles must not be parked for longer than 45 minutes in the Central Traffic District, nor for longer than one hour in a Business District, between the hours of 7 a. m. and 6 p. m., nor at any place in the city for longer than 30 minutes between the hours of 2 a. m. and 4 a. m.

Parking Position.—No vehicle shall be parked closer than 2 feet to any other vehicle, nor other than parallel with and within one foot of the curb except where angle parking is required by the police.

Merchandising Vehicles.—Vehicles shall not be displayed for sale by parking them upon any street. Vehicles from which merchandise is being sold shall not be parked in the Central Traffic District nor in any Business District.

Street Cars

Right of Way.—Vehicles must be removed from tracks as soon as possible after signal by motorman.

Blocking Streets.—Trains of cars shall not block streets for more than five minutes.

Speed.—Same as for motor vehicles under State Law.

Overtaking Street Cars.—Vehicles must not be driven past moving street cars within 100 feet of an intersection being approached. Vehicles shall be stopped to the rear of the nearest door of a street car loading or unloading passengers. Vehicles after so stopping may proceed with caution if there is a marked safety zone in the roadway. Vehicles must remain standing while the car is loading, however, where there is no safety zone.

Boarding Cars.—Persons shall not board nor alight from moving cars or vehicles.

Riding.—Persons shall not ride upon the fenders or running board of any street car or vehicle.

Maximum Penalties

First Offense—$50.00 and five days.
Second Offense—$100.00 and ten days
Third Offense—$500.00 and six months.

CHAPTER XII

THE TRAFFIC BUREAU: ORGANIZATION AND PERSONNEL

No matter how much care has been given to the formulation of the traffic code chaos will result on the streets unless adequate provision is made for its enforcement. Many users of the streets will be ignorant of the rules set forth; a few will maliciously violate them; and all will require the assistance of some official moderator to determine their respective rights when traffic becomes dense. The traffic code applies to all parts of the city and should be enforced with as much care as public facilities permit. There are some parts of the city, however, where there are so many conflicts between the rights of individuals that the mere enforcement of regulations is not enough; here traffic must be directed.

The task of enforcing the traffic regulations, and of directing the actions of drivers and pedestrians has been given into the hands of the police. This function is relatively new in police work, having arisen with the growth of motor traffic, and it is interesting to note the manner in which it has developed, and the promises which it has for a future alleviation of street troubles.

Before the year 1900, the police had no duties in connection with traffic direction beyond the incidental preservation of peace between wrangling drivers, or the assisting of some infirm persons or children over a dangerous crossing. The increase of motor traffic, however, made it apparent that unless the police took a hand in the matter conditions would become intolerable. Among the earliest traffic officers were the mounted police assigned to the duty of directing traffic on Fifth Avenue in 1903. The increased importance of the function is indicated by the fact that the New York force now has approximately 2,000 members whose sole duty is the care of traffic conditions. In all of the larger American cities, and in many of the smaller ones, the traffic police form an important part of the police department.

An average of about 10 per cent of the force is assigned to this duty.

So vital a part do these officers of the law play in the solution of the problem of street congestion and safety, that every effort should be made to see that their organization, training, methods, and equipment are such that they will be able to act with the greatest degree of effectiveness.

ORGANIZATION OF THE TRAFFIC BUREAU

The general conclusion among police administrators is that the function of traffic direction is so different from other classes of police service, that it can be carried out most efficiently under a separate organization.[1] To this end traffic bureaus or divisions have been created, and placed in charge of special executives, subject, of course, to the supervision of the commissioner or chief of police. This has had a very desirable result for it has made it possible to assign men permanently to this specialized service; it has made stricter discipline possible; the knowledge of officers in charge has been more effectively applied; a different police technique for dealing with traffic problems has developed.

Wherever the traffic bureau has superseded the general police control of traffic, perceptible improvement in conditions has resulted. Boston's experience is typical. Before the bureau was created control was inadequate, irregular, and almost entirely lacking in responsibility. As many as three different station captains took jurisdiction over the same intersection during a 24-hour period. In pleasant weather, patrolmen who were too ill to walk their regular beats were given traffic assignment; in bad weather, the assignment was used for discipline. Under such methods uniformity or effectiveness in regulation was impossible. With the organization of the traffic bureau

[1] INCHES, J. W., *Traffic Problems of the Future, in Proceedings of a Conference on Highway Traffic Regulation*, under supervision of the Highway and Highway Transport Education Committee, p. 29, Washington, 1921.

The importance of traffic on our city streets has reached a point where it should be handled by a department composed of men giving their entire time and thought to that subject. It may or may not be a part of the general police department. If it is, it should be a bureau entirely apart from ordinary police work. While the men who enforce traffic regulations upon the street will probably always be a part of the regular police force, the study of traffic problems and the making of regulations should be carried on by men who are highly trained and specialized in that subject.

in 1919 there was an immediate change. An *esprit de corps* was created among the members of the squad; it became an honor in the police department to be a traffic officer as only the most fit were chosen for the position. Discipline of a semi-military type was instituted; neatness in appearance was required; uniformity and precision became the rule. The change in organization and method was reflected in the safety and speed of traffic flow. Drivers knew what was expected and responded with cooperation to courteous and exact direction.

The following table indicates the origin and composition of typical traffic bureaus in the larger American cities.

THE ORGANIZATION OF TYPICAL BUREAUS

City	Date organized	Number in entire force	Number in traffic police	Foot officers	Horse officers	Motor cycle officers
Baltimore	1911	1,200	97	77	5	15
Boston	1919	1,901	154	147	7	[1]
Cleveland	1916	1,200	179	96	59	24
Chicago	....	6,000	519	379	140	[1]
Detroit	....	2,076	300	200	50	50
Kansas City	1921	550	58	50	None	8
Philadelphia	1908	4,995	626	306	108	212
Pittsburgh	1912	762	138	102	24	12
Los Angeles	....	1,500	206	150	6	50
Portland, Ore	1917	373	45	37	None	8
St. Louis	1923	1,749	162	81	54	27
San Francisco	1911	1,033	59	44	7	8
Washington, D. C.	1923	931	...	75	[1]	10

[1] Mounted police and motor cycle police attached to other divisions of the police department. These figures were collected in the summer of 1923.

In Massachusetts the organization of a strong central motor vehicle department or division has had a very salutary effect upon the uniformity of law enforcement throughout the state, and has afforded an opportunity for the coordination of the efforts of the local police and the county officials.

In practically all of the states the local law enforcement bureaus are handicapped because they are not supplied with information necessary for prosecutions. Often it is impossible

to stop the offenders at the time of a violation, and the only identification that can be obtained is the license number on the vehicle. This is especially true where those drivers who have been involved in an accident fail to stop to render assistance. The writer was informed, in one state, that it usually takes 3 weeks to obtain a reply from the State Motor Vehicle Department on requests regarding the individuals to whom various licenses had been issued. Much of this difficulty would be overcome if arrangements were made for daily or weekly cumulative reports from the State Motor Vehicle Department to the local police officials regarding the new registrations of vehicles. In Connecticut the State Commissioner of Motor Vehicles maintains a 24-hour telephone service so that his office can be called by police officials or others at any time, day or night, and the working out of this system has made it possible to furnish identification for police purposes and for individuals at a moment's notice. It is no longer even necessary for purposes of identification to have the registry number, for with other descriptions such as make, type, color, and model it is possible for the department to furnish a close approximation of the actual ownership of the vehicle.[1]

Another way in which the state department could assist more fully than it now does in most states would be in keeping records of the convictions of the more serious offenses against the vehicle act, and providing local police officers and magistrates with such information.

All of the activites of the city in connection with the enforcement of rules and the direction of traffic should be centered in the traffic bureau. In a number of cities the motor cycle police and the horse men are under the supervision of other parts of the police department or under the park commissioner. In a number of cities, also, the park commissioners regulate traffic through officers attached to their departments and not to the bureau. Thus, in Chicago, there are several authorities exercising jurisdiction over street movement in the same locality. Such a separation works for a lack of uniformity in direction which is confusing to the driving public. Also the practice of dividing the city into traffic districts or precincts, and attaching traffic police to various stations instead of to the central traffic bureau,

[1] *Report of the Commissioner of Motor Vehicles*, p. 31, State of Connecticut, Hartford, 1922.

prevents the growth of desirable discipline, and complete harmony of procedure. In Pittsburgh, for example, the city is divided into six districts for traffic control, and the authority of the traffic bureau is exercised only indirectly over the members of the squad. In Detroit there are eleven precincts, but these are entirely for administrative purposes and all the members of the squad report to traffic headquarters, and are directly responsible to the Inspector of Police in charge of that work. In metropolitan areas where the police are more or less directly under state control it seems desirable that a traffic organization of the entire district should be established. In Boston, for example, there are a score of separate municipal corporations within a radius of as many miles from the center of the city proper. Those driving in and out of the city must thus pass through a number of separate police jurisdictions. The state law creates a certain amount of uniformity in regulation, but the methods of the police in the different communities cause confusion. Where there are large metropolitan park areas it is not uncommon to create a park police which takes charge of law enforcement within the entire park district without regard to the particular corporation limits. There appears to be no reason why a similar provision should not be made for a metropolitan traffic police to function throughout the greater city limits.

In addition to the administrative head of the department, whose task is chiefly the direction of enforcement, there is a growing practice, indicated in New York and in Boston, to appoint as a supervisor over the traffic work, a Deputy Police Commissioner, whose duty is not only to see that the work of the bureau is well done, but who is likewise charged with the duty of assisting in the formulation of rules for the improvement of conditions. This marks an important step in the development of the work of law enforcement, and direction for it makes possible the combination of a police disciplinarian and administrator with a technical civilian expert. The success of the plan will depend upon the ability and willingness of the city to select commissioners for the task who have a special training and ability in traffic matters.

The Functions of the Traffic Bureau.—Not only have the traffic bureaus grown in size so that they now contain on an average approximately 10 per cent of the entire force, but the older and more progressive departments have developed special functions and divisions of activities within their own organization.

The first and most important function of the traffic police is to enforce the laws and direct traffic. As will be pointed out later, this task demands a special type of individual, possessing a special training, and having proper equipment. This function was considered for some time the chief and indeed the only activity of the squad.

With the increase of congestion, however, and especially with the increase of traffic accidents and deaths, it was felt that the mere direction of traffic and the punishment of offenders was not adequate. Hence to the punitive activity of the traffic police there has been added the preventive. The best time to deal with congestion or with accidents is before they take place. The better bureaus in the country have therefore undertaken a program of public education, assisting drivers to such a knowledge of the law and of the common-sense rules of safety that fewer of them will offend. The pedestrians have not been neglected, and anti-jay-walker campaigns such as that carried on in New York, are becoming more numerous.

A third function is being assumed by the police: that of investigation. For a long time the detective bureaus of the great police departments have been making an investigation of crimes with the result that criminology has been developed to a relatively high degree. Until the past few years but little attention has been given to the study of street traffic accidents, either as individual occurrences or in groups. When a citizen was killed with a blow from an iron bar, a number of detectives were immediately sent to the scene of the crime, and much time was spent in attempting to find the cause of the death. When a citizen was killed by a blow from the steel bumper of a motor, however, it generally created much less stir among the police: it was an *accident*. More attention is properly being given to automobile deaths and to a determination of responsibility.

These three functions of the traffic police—direction, education, and investigation—have probably been more highly developed in connection with the traffic bureau of the Detroit Police Department than in any other city. For that reason the methods and organization for the carrying out of these functions in that city are described in some detail.

The Detroit Traffic Police.—The entire bureau or Division of Traffic Duty is under the immediate supervision of an inspector, appointed by, and responsible to, the Commissioner of

Police. The superior officer as indicated in the previous chapter is charged with the making of a large number of special rules and regulations, which have the force of ordinances. Two hundred police are assigned to permanent traffic duty, and in addition there are fifty motor police and fifty mounted men, though the latter group is organized in a separate division. Enforcement is assisted by a variety of mechanical aids to be described later.

In addition to the organization for the enforcement of regulations, there is an accident investigation bureau. This division was originated in 1920 and was put in charge of two detective lieutenants, employing ten men. The number of investigators has been increased to twenty, and there are a number of civilian clerks employed. Briefly, the function of the bureau is to see that every traffic accident which results in an injury or death is promptly and carefully investigated, not only for the purpose of ascertaining possible blame, but to determine the conditions under which accidents take place.

Upon receipt of information that an accident has taken place, an investigating squad is sent from headquarters in an automobile. Here the first job is to interview witnesses who are still present, and to get the names of others who may have been present at the time of the accident. The investigators make notations of the positions and conditions of the vehicles involved, measure distances, and if possible secure pictures of the situation. From these data a chart is prepared by the city engineer's department, which may later be used for purposes of prosecution.

This method of investigation was found to be a great improvement over former conditions. Before the organization of the investigation bureau no one was definitely charged with the responsibility of obtaining the necessary information. Even when a patrolman happened to be present his limited knowledge of this type of investigation did not make it possible for him to gain sufficient data. Frequently the witnesses had gone and the vehicles had been removed before the representative of the law arrived. The investigators connected with the bureau have made a special study of traffic accidents, and have been able to develop a skill in this type of work, which makes their reports comprehensive and accurate.

A full record is made of all reports on accidents, and is filed in the bureau. These records include not only data concerning the

accidents investigated, but the ultimate disposition of the case as made by the court. The records of the department serve as a valuable source of information for the public prosecutors, and also form a basis for an analysis of street hazards.

The Detroit experiment with accident investigation has proved so successful that other cities are likewise making provision for an exercise of this function. New York, Baltimore, and Philadelphia now have public safety, or accident investigation bureaus.

The educational function in the Detroit Department is carried on through a Bureau of Public Safety in charge of an officer experienced in publicity and safety work. On the basis of knowledge obtained by the Accident Investigation Bureau, this officer and his assistants prepare warnings for the public against those practices which have proved especially hazardous. Simple digests are made of the traffic ordinances, with special emphasis on new rules and regulations which have been made by the Commissioner of Police. The assistants in this bureau deliver safety talks in the public schools, at meetings of clubs, and at other gatherings. Under its supervision and in conjunction with the Detroit Safety Council, special publicity is provided for *safety weeks*. This bureau has organized a driver's school which registers as many as 500 students at one time, and affords a method of training prospective drivers who have failed to pass the driver's examination, as well as more experienced operators.

In New York the Bureau of Public Safety under the direction of Marcus Dow has done effective work in educating the public in safe and proper driving methods. The organization and work is explained by the director as follows:

> We selected from the great uniformed police force of the city of New York sixteen men of the rank of lieutenants who were assigned to us by the Police Commissioner and who are now devoting their entire time to the safety work of the Bureau of Public Safety. These men have been doing wonderful service in spreading the gospel of safety among chauffers and drivers, and particularly among school children . . . They made a special drive in the garages throughout the city, appearing there in uniform, and in a heart-to-heart and man-to-man sort of way conveying concrete and definite safety instructions and messages to the drivers of motor vehicles in the city. These men have conducted several hundred of these meetings in garages during the spring months

of the year and conveyed their message to approximately 30,000 chauffers and drivers in that period.

THE PERSONNEL OF THE TRAFFIC BUREAU

The director of the traffic bureau should have under his supervision a sufficient number of police to care adequately and efficiently for the actual direction of vehicular movement in the congested portion of the city, and for a sufficient supervision of traffic in all parts of the community, so that drivers at all places will feel that they must abide by the law. One of the chief difficulties experienced thus far is that inadequate appropriations have been made for the support of traffic bureaus and that too few men have been available for this work. Where there is definite need for more complete enforcement, this is a type of economy which has very serious consequences both in economic loss through avoidable congestion, and through increased accidents and deaths. In a number of cities it is estimated that a traffic division possessing twice the present number of men would not be fully prepared to deal with existing traffic demands. Not only has there been difficulty in obtaining a sufficient number of men for this important branch of the service, but the salary scale and conditions of the employment have been such that it has been difficult to obtain men possessing proper qualifications.

The Personal Equation.—In building up a good traffic squad the personal equation is the first which must be considered. Twenty traffic directors of American cities have been asked their opinions as to the type of man who makes a good traffic officer. Many characteristics were indicated, but two were outstanding—physique and intelligence.

Height is particularly desirable. The officer who controls an intersection is often surrounded by pedestrians who block his view unless he is able to see over their heads. Height, moreover, adds to the effectiveness of his signals. One traffic director has indicated that he is making it a practice to take no men who are under 6 feet in height. The conditions under which the crossing officer works demand that he be a man of considerable strength if he is to do his work well. His job is an active one, and if his street is busy and he is an alert officer there are few moments during his tour of duty when he can relax. Observation of traffic behavior at various intersections and in various cities

indicates that vigor and snap on the part of the officer results in greater speed and certainty of vehicle and pedestrian movement. The activity of the officer serves as a spur to the public. Another reason why strong, well-proportioned officers are usually more successful than others lies in the psychological effect which they have upon drivers. The officer's appearance tends to lend authority to his directions.

There are a number of reasons why the traffic officer should have somewhat more than the common run of sense. His duty brings him into constant and close relation with the public. Indeed, there are no agents of the city by which its efficiency is judged more frequently than by its traffic police. In addition the task demands a sustained use of good judgment and discretion. The freedom of movement and safety at the intersection depends on a head that can keep cool in any emergency.

Training.—Traffic direction and law enforcement is becoming more complicated year by year. It is no longer a suitable task for the amateur or for the policeman who has not had special training in this branch of the service. Experience on the street alone is no longer considered adequate, for though it is valuable and necessary, there are many things which the traffic officer can learn in no other way than through special instruction. To supply an adequate number of trained police for traffic service, special courses have been instituted in connection with the police training school in several cities. In New York City a 2-weeks' course is given and only those who are able to pass its requirements, and show special aptitude for traffic work are selected for the squad. The course covers the state laws and local rules and regulations, as well as the most improved methods for directing traffic.[1]

Military discipline summarized much which the ideal traffic officer should possess. This is not only for the purpose of giving him the proper attitude toward his superior officers, but it affects his standing and relation with the public. The well-groomed, upstanding, military-like officer has an authority over the traffic which he controls which is not possessed by the careless, slovenly officer. Appearance is of prime importance, and American cities illustrate both extremes of good and bad. As an example of the former, Boston may be taken as an example, where it is

[1] GRAPER, ELMER D., "American Police Administration," p. 167, New York, 1921.

said no one has ever seen a spot on a traffic officer's uniform. This somewhat exaggerated statement is merely indicative of the pride which the citizens of that city take in their traffic squad. It is reasonable to think that where people can respect their police and consider them an asset to the community they are more apt to give a cheerful obedience to their directions. Military discipline of the proper sort will also give the officer a correct idea of deportment. No public agent has his temper tried more frequently than the policeman on a busy intersection, but this should be no excuse for surliness. It is only the officer who can maintain his dignity, meet his public firmly but cheerfully at all times who will gain respect for himself and the force and establish friendly relations with the public, without which successful regulation is impossible.

To employ an officer for traffic duty who knows nothing about the workings of the element with which he deals is as incongruous as to employ a life guard who does not know how to swim. Each unit of traffic has certain abilities and limitations. It would seem reasonable to require that all traffic police should be familiar with the operation of all the standard type vehicles, horse-drawn included. Indeed one department is contemplating such a requirement. The officer should be able to put himself in the position of the driver. Such knowledge will not only work for a more effective and safer regulation of traffic, but will make it possible for the officer to assist intelligently in clearing the street of stalled machines, and of machines whose drivers have become incapacitated.

A thorough knowledge of the rules and regulations of the state and city appear so fundamental that there should be no need of emphasis. Yet if the individual will read the provisions of his local code he will in all probability find it so detailed and often so ambiguous that it is not readily understood or retained. The mere study of the details of the laws in the training school is helpful especially if simple and intelligent explanations be given, but constant review is necessary. Commissioner Harry Jackson while in charge of the Detroit Traffic Bureau inaugurated the method of a weekly examination. The members of the squad were given printed digests of portions of the state and local regulations for study, and at the end of each week were required to write answers to questions on the assignment. Demerits were given for failure in the tests, and by this means all of the

important provisions of the code were kept fresh in the minds of the men.

From the standpoint of safety a mere enforcing of the law is not adequate. There are many hazardous practices which are not forbidden by statute or ordinances but which nevertheless result in accidents and death. Those men who are charged with the protection of life and safety of citizens on the streets should know how to prevent disaster as well as to avenge the public upon offenders. A driver may be unaware of the fact that his lights are improperly, though perhaps not illegally, adjusted; that his machine has been damaged in such a manner as to render it dangerous; that his brakes do not function as quickly as they should; or that some method of driving creates a hazard. A friendly word of warning from an officer whose training has made it possible for him to recognize such dangers should have a desirable effect.

The traffic officer is the principal walking information bureau of the city. This is a function which frequently hampers his ability to care for the needs of traffic, but it is one which will serve as less of a hindrance to his main duty if he is thoroughly prepared to answer the more general questions. Every officer should be required to know and to be able to give clear and concise directions to streets and prominent places in the neighborhood of his post.

That part of the training which deals with signaling is of such importance that some elaboration seems proper. Notwithstanding the introduction of semaphores and signal lights the hand signal must remain an important method of communication between the officer and the public. The rapidity and safety of traffic flow depends to a considerable extent upon the uniformity, visibility, and clarity of these directions. In some cities it is necessary to learn the peculiarities of each individual officer before one can drive with safety.

The signals originated by Captain Bernard Hoppe of the Boston Traffic Police and now in use throughout the metropolitan area have been widely praised, and are, in the opinion of the writer the best yet designed.

It will be noted in the following directions that all movments are executed above shoulder heights thus giving them the greatest possible visibility. At noisy intersections the signal is immediately preceded by a whistle to call the attention of drivers

and pedestrians to the fact that a change in traffic is to take place. In the training school the signals are given as a manual of arms, and every recruit must know them perfectly before he is given duty. It is to the uniformity and precision of these directions that much of the regularity and certainty of vehicle flow in Boston can be attributed.

To Stop Traffic from the Right:

Turn the body slightly to the right, look over the right shoulder, raise right arm at an angle of 45 degrees, palm of the hand toward the vehicle to be stopped. Hold until signal is obeyed.

To Release Traffic from the Right:

Look over right shoulder, raise arm at an angle of 45 degrees, palm front, and swing arm to the left across face.

To Stop Traffic from the Front:

Raise left arm at an angle of 45 degrees to the front, with palm toward the vehicle to be stopped. Hold until signal is obeyed.

To Release Traffic from the Front:

Raise left arm at an angle of 45 degrees to the front, with back of hand toward the vehicle, and swing hand back over left shoulder.

To Stop and Release Traffic from the Left:

Same as from right except executed with left hand.

To Warn Pedestrians Right and Left:

Raise both arms horizontal with shoulders, palms toward the pedestrians.

To Release Pedestrians Right and Left:

Raise both arms horizontal with shoulders, palm front, and swing arms across chest.

The traffic officer's task is no longer one that can be carried out successfully by the casual police officer or the untrained amateur. Several of the larger cities of the country have taken the lead in raising the position to one of expert and professional standing. So far as results can be judged at present the change is working for greater safety in our streets and at the same time for their more efficient use by the public.

The Classes of Service.—The typical traffic bureau carries out its function through the use of three classes of police officers; foot, mounted, and motor. The distribution of the personnel among these three groups depends to a large extent upon local conditions.

The foot officers have always been the most numerous, and still remain the chief agents, for the control of traffic conditions

in the more congested portions of the city. They can easily take up their positions in different parts of the crossing as conditions of traffic demand; they are free to move quickly to avoid being run down by on-coming vehicles; their attention can be given to the freeing of jams, or to directing the movements of pedestrians. The officer on foot can also be used to advantage to observe parking violations, and to inspect the movement of vehicles through alleys and other restricted places.

Mounted officers were among the first to be used for traffic direction, and they are still retained by all but two of the larger bureaus. The policeman mounted on horseback has a number of advantages: he can move with greater speed than the foot officer; his elevated position makes it possible for him to observe conditions which would not be seen from the ground; and he has greater authority over pedestrian crowds. Notwithstanding these advantages, however, the mounted squad seems doomed to retirement so far as traffic work is concerned, with the possible exception of use in the market districts of some cities where there is still a considerable amount of horse-drawn traffic. In the congested part of the city there is little need for roving duty, and where the need exists it can be done more quickly by the foot officer, and it has never been advocated that mounted men be assigned to a fixed post. In the outlying districts the mounted officer is not equipped to deal with high-speed motor traffic.

The duty of the mounted man is gradually being taken over by the motor cycle corps. It is a branch of traffic work upon which growing emphasis will probably be placed. The officer equipped with a motor cycle is usually more than a match for the most reckless speeder. His chief value, however, lies in the fact that his great mobility makes it possible for him to cover a large amount of territory, and thus spread the authority and control of the police department to all parts of the city. Motorists hesitate to violate the law even in the outlying districts where the motor police are known to be active.

Auxiliary Police and Vigilantes.—Even with a large personnel and the best of equipment the uniformed police can actually supervise traffic and observe the operation of but a small per cent of the vehicles on the street. The regular police in addition to those who deal especially with the enforcement of the traffic ordinance should, of course, be instructed to report violations and, in cases of necessity, direct traffic. In a number of cities

there has been an attempt to utilize the services of a special group of citizens organized into a body variously known as the Vigilantes, Police Assistants, Citizens Committee. In some places these citizens report to the traffic bureau violations which they have observed; in others the reports are made to an automobile club or to a Local Safety Council.

In Detroit any citizen who desires is supplied by the police with what is known as a "citizen's complaint card." Frequently the newspapers also print a blank form of this report which can be cut out and handed in by those who observe traffic offenses. The police report form is printed on the back of an addressed post card and provision is made for the noting of information concerning the date, time, license number, place, and details of the violation, together with the complainant's name and address. In addition to the distribution of these forms to interested citizens who volunteer their services, there has been organized a Detroit Public Safety Auxiliary, in connection with the Bureau of Public Safety of the police department. From these two sources complaints against traffic violators are constantly being received. These reports are handled by the Accident Investigation Bureau, and to this bureau a large percentage of those who are reported are summoned and given warning and instruction. The writer is informed that some trouble is caused because of the inaccuracy of the reports, mistaken license numbers and so forth, especially among those which are received from the general public.

In Kansas City a Vigilante Committee has been organized in connection with the Local Safety Council, and membership on the committee is restricted to the members of the council. The committee is in no way connected with the police department of the city, though it affords the department much valuable information. Those who have been accepted as members are given a certificate indicating their appointment, and a supply of report blanks similar to those used in Detroit. Definite rules have been drawn up governing the actions of the Vigilantes which may serve as a basis for similar organizations in other cities. They are in brief as follows:

1. Vigilantes will not carry firearms at any time.
2. Each member will carry his identification card.
3. The Vigilante Committee will expect each Vigilante to obey unerringly all traffic laws, thereby setting an example for the driving public.

4. Only in exceptional cases should members personally try to correct or expostulate with offenders of the traffic laws. Members have no police power and lay themselves open to insults when they stop offenders.

5. Vigilantes, in making reports, should use the greatest care in obtaining the correct license numbers, the style of the car, and, where possible, the make. Members should bear in mind that it is better to pass up an offense than accuse an innocent driver of a violation.

6. Vigilantes will devote particular attention to such violations as: automobiles passing street cars while the latter are loading or unloading passengers; automobiles passing street cars to the left; cutting across traffic recklessly; driving recklessly through groups of pedestrians; passing school zones at high rates of speed.

7. In case members find it necessary to have drivers arrested the following method should be followed: call a policemen and explain the case to him but do not order an arrest. Leave the question of whether an arrest should be made for the police to decide. (The Safety Council is legally informed that if Vigilantes order arrests they make themselves personally and financially liable for the false arrest in case there should be an acquittal.)

In St. Louis in connection with the Safety Council of that city a Vigilante Committee similar to that in Kansas City has been formed. In both cities a letter is sent to the offenders pointing out the violation and requesting his cooperation in the reduction of accidents. In St. Louis arrangement has been made whereby the names of those individuals who have been reported more than twice are turned over to the police and to the municipal judges for further action.

Los Angeles affords an example of a Vigilante group organized in connection with an automobile club. Under the direction of the Public Safety Department of the Automobile Club of Southern California, several hundred members of the club who are willing to serve in such a capacity are selected to report upon violations. Reports are received and letters are sent by the department to the offenders.

Observation of the working of the vigilante committees throughout the country leads to the belief that they are most apt to be successful and an assistance when the members are carefully selected and properly instructed in their duties, and this can usually be done only when they are members of some responsible organization. Only those, who indicate their willingness to appear in court as witnesses in case an arrest follows the violation,

should be admitted to membership. The activities should be educational rather than punitive, and the best results appear to be obtained when the duty of issuing warnings and instructions is vested in the traffic bureau.

In a number of cities attempts have been made to utilize the services of boy scouts and other organizations as an assistance to the police department. For special services, such as the establishment of lines at parades and similar occasions, they have functioned with some success. Similarly, junior police have been organized in the schools to police the crossings in the localities of the buildings, and they have been able to exercise beneficial control over the actions of the children.

In some cities civilians attempt to control traffic at busy intersections in the outlying districts where the police are not stationed. Notwithstanding the presumably good intentions of these individuals they usually succeed in creating more confusion than order. Whenever an intersection becomes so busy that it needs policing the task should be undertaken by the uniformed police, and if this cannot be done drivers should be permitted to exercise their own discretion. Amateur direction is usually worse than none at all.

Relation between the State and the Local Enforcement Organizations.—The problem of regulating street traffic has been, and probably will continue to be, a problem for the locality. Suggestions have been made at various times for the organization of a state-wide police under the supervision of the State Motor Vehicle departments for the control of traffic throughout the state, within as well as outside the limits of incorporated towns, but in no place has the suggestion gained wide approval. While the problem is one for the localities to handle, it is no longer possible, because of the large amount of intercity travel, to permit each locality to act in an entirely independent manner. Not only should the state law lay down certain general principles of regulation which should apply throughout the state, but provision should be made for the enforcement of these regulations.

States vary greatly in the organizations which they have provided for this duty. The state motor vehicle bureaus have too frequently been organized for the sole purpose of collecting revenue. The bureaus have been an incidental organization in one of the departments of the state and have received but little careful supervision. In other states greater care has been given

to this organization and it has been put into the hands of a Commissioner of Motor Vehicles who possesses power to function in connection with the enforcement of the state vehicle law, as well as in the collection of revenues.

The need for a strong state organization is threefold. First, without some such agency the local enforcement of the provision of the state law will become so irregular and unequal in various communities that in some, hazardous practices will be permitted, while in others, motorists will be treated with undue severity. Second, the jurisdiction of the local police extends only to the limits of the incorporation in which they function, and there is necessity for coordination with some enforcement body capable of acting in the territory outside of the towns and cities. Third, the state possesses information regarding the identification and address of automobile operators which must be furnished the local officials if they are to be able to act most effectively.

The lack of uniformity in enforcement which results when there is no agency capable of functioning in an active manner throughout the state is described by a police official of long experience:

While it is of great importance to pass the necessary laws[1] regulating the use of automobiles on the streets and highways, the mere passage of such laws will not in itself cure the present conditions unless there is provided an efficient and uniform system of enforcing these laws. It is

[1] *Transactions of the Commonwealth Club of California*, vol. 17, 12, p. 486, San Francisco, 1923. *The California Motor Vehicle Act of* 1923, sec. 30, provides that the Chief of the Division of Motor Vehicles is empowered to enter into contracts with the supervisors of the various counties, to appoint inspectors and traffic officers to enforce the act, and to pay their salaries out of the "net receipts of the motor vehicle fund which such county is entitled to receive" under the provisions of the act. Attention is called to a model law framed by the above organization, same reference, pp. 558–559.

The Commonwealth of Massachusetts, Legislation, Rules and Regulations Relating to Motor Vehicles, Boston, 1922, sec. 29, provides that "The registrar shall appoint competent persons to act as investigators and examiners, and may determine their compensation and terms of service and define their duties. Said inspectors and examiners, with respect to the enforcement of the laws relating to motor vehicles, shall have and exercise throughout the Commonwealth all the power of constables, except the service of civil process, and of police officers, including the power to arrest any person who violates any provision of this chapter, and they may serve all processes lawfully issued by the courts, the division, or the registrar.

true that certain counties in the state make an attempt to enforce the laws, but these attempts are the cause of a great deal of complaining. It was charged before the section that in these counties too much effort of the traffic officers is directed in attempting to arrest non-resident motorists who happen to exceed the speed limit on some country road where there is established a speed trap; that these officers are, of course, influenced by their desire to collect fines which go to the support of the local officials. The proposed measure which the Section desires to present to you will not, it is true, do away with the authority of the cities and counties to enforce motor vehicle laws, but will provide a well-organized and efficient state police organization which will enforce the laws on the roads and highways where there are, at the present time, no traffic officers at all, and who will cooperate with the local officers in those places having local traffic officers, and by example tend to standardize enforcement and thereby minimize these practices.

CHAPTER XIII

POLICE EQUIPMENT AND AUXILIARY DEVICES FOR TRAFFIC DIRECTION

EQUIPMENT

With the growth in the complexity of the traffic officer's duty it has become clear that his work can be done well only when he is provided with proper equipment. The increasing burden of the traffic problem has, moreover, made necessary the development of auxiliary regulating devices to serve in those places where officers cannot be stationed. Numerous types of specialized equipment and regulating devices have been adopted during the past few years.

Traffic Officers' Uniforms.—Traffic bureau executives in most of the larger cities have concluded that the authority of the traffic officer is increased when he is provided with a uniform which distinguishes him from the regular police. It has also been found that a special uniform has served to give the men greater pride in their work. The most widely used uniform for the traffic service is one composed of a standard police cap, tight-fitting blouse, riding breeches, and leather puttees. This type of uniform serves to distinguish the traffic officer from the regular patrolman, thus identifying him as a police officer who has special authority over drivers, and in addition is one which is especially suited to the task. The officer in the street is in close proximity to moving vehicles, and especially in bad weather finds it difficult to keep a regulation uniform with long trousers in presentable condition. Even though no distinguishing uniform is used it is general practice to provide traffic officers with a brassard usually with the symbol of a horse's head or wheel to indicate the special service to which they belong.

In a number of cities both a winter and summer uniform is used. The seasonal uniform is especially necessary for the traffic police inasmuch as they are exposed to the elements during the greater part of their tour of duty. In Philadelphia the summer uniform is similar to the winter uniform with the exception that

the blouse is omitted, and the officers wear gray flannel shirts and black ties. In Baltimore the summer uniform is a white shirt with black tie worn with the regulation blue trousers. The St. Louis summer uniform is made of light cotton material, and the officers wear pith helmets. For winter service the officers should be provided with military type, knee-length, overcoats.

Cities vary as to practice regarding the furnishing of uniforms. In some places the officers must buy their own, while in others

FIG. 23.—A member of the Washington squad.

they are furnished by the city. But no matter which practice is followed the officers should be required to keep their uniforms in such condition that they will be able to pass a rigid inspection at any time.

Increasing the Officer's Visibility.—Recently the question of greater visibility for the traffic officer has been agitated. The discussion has been occasioned by the fact that during the even-

ing hours it is difficult for drivers to see the officer at a busy intersection; that signals are not distinct; and that the job of directing traffic has become unnecessarily hazardous. In Boston, for example, sixty-two officers out of a total one hundred and fifty-six were injured during a single year; during the same period seventeen were injured in Cleveland, and seventy-three in Chicago. A number of devices have been used successfully to increase visibility. One of the simplest and most effective is the white glove or mitten. In the winter the glove is made of heavy material and takes the place of regulation equipment, while in summer the glove is of a light cotton material. The white gloves against the dark uniform afford a striking contrast and assist in making clear the manual signals. White belts and shoulder straps are other devices which have proved of value. When first introduced they were not popular with the men, for it was felt that they were too conspicuous, but the advantages were soon realized. The Boston traffic police are now regularly provided with this type of equipment which they are required to wear after dark. The white rubber slicker is another piece of personal equipment which has proved of assistance. Probably the most effective device which has yet been utilized to increase the officer's visibility is the flood light. These lights are mounted on special poles, on nearby buildings, or from wires, and throw a beam of light on the officer. Such lights have recently been installed at all of the more important intersections in Boston, and have proved of considerable value. The light not only throws the officer and his signals into clear relief, but likewise assists in illuminating the intersection.

The Use of Whistles.—The question as to whether officers should use whistles in the directing of traffic is one which has long been discussed. In some cities stopping and starting of traffic is controlled entirely by whistle, one blast being given for east and west movement and two for north and south, or *vice versa*, while in other cities whistles are not used at all. The chief disadvantage of the whistle lies in the fact that it is often a cause of annoyance to those living or working in close proximity. Certainly every attempt should be made to eliminate its use near schools and hospitals, and in general in the residential district. Another disadvantage is to be found in the fact that where the sole reliance is placed on the whistle, and hand signals are neglected, those unfamiliar with local regulations are apt to

become confused. On the whole, the advantages of the whistle appear to outweigh its defects, however, and it is now coming back into general use. The most important value of the whistle lies in the fact that it attracts the driver's attention to the officer. The best practice of the country indicates that the whistle should not be used for the giving of signals, but should be used as a means of assisting the officer in making his hand signals. When thus used a blast of the whistle should be given immediately before each change in traffic movement. Electric bells have been used to advantage in a number of cities, though usually in connection with a system of signal lights.

Platforms and Shelters.—Every attempt should be made to add to the comfort of the traffic officer. To stand on a hard pavement for many hours each day is not pleasant under the best of conditions, and may actually serve as a handicap to efficient work in extremely hot or cold weather. The simplest relief, and one which is widely used, is to provide the officer with a small platform, 3 to 4 inches in height, and approximately 2 feet square, upon which he can stand the greater part of the time.

Exposure to the weather and danger from passing vehicles have resulted in the adoption of a number of devices for the officer's protection. One of the simplest types of shelter is that used in Baltimore. The officer is provided with a platform standing several feet above the pavement. The platform is surrounded by sheet metal which is painted with diagonal black and white stripes to render it more visible. A more elaborate shelter is to be found in the Detroit *crow's nest*, or traffic post which provides the officer with a raised platform 6 to 8 feet above the pavement. A cover protects him from the elements. Even more elaborate shelters are used in connection with the Detroit, New York, and Chicago signal towers. Since hand signals are unnecessary in these systems it is possible to provide the officers with shelters which are capable of being entirely enclosed and heated in cold weather. Raised and enclosed shelters have several disadvantages which limit their usefulness. The officer tends to be less active in the direction of traffic, and the speed of movement is thus lessened. When shelters are erected in the roadway they afford an obstruction to traffic flow. The officer, moreover, is kept in a fixed position and cannot move about so readily to accommodate himself to the changing needs of the cross-

ing. The umbrella semaphore affords one of the simplest protections without unduly restricting the officer's movements.

Typical Practice in Equipment

City	Whistles	Distinctive uniforms	Gloves and belts	Flood lights
Baltimore	Yes	No	Yes	Yes
Boston	Yes	Yes	Yes	Yes
Cleveland	Yes	Yes	No	Yes
Chicago	Yes	No	Yes	No
Detroit	Yes	Yes	Yes	Yes
Kansas City	Yes	Yes	No	No
Los Angeles	Yes	No	Yes	No
Philadelphia	Yes	Yes	No	Yes
Pittsburgh	Yes	Yes	No	No
Portland, Ore	Yes	Yes	Yes	No
St. Louis	Yes	Yes	Yes	Yes
San Francisco	Yes	Yes	No	No
Washington, D. C	Yes	Yes	Yes	Yes

AUXILIARY DEVICES FOR TRAFFIC DIRECTION

Traffic Signs.—One of the most important aides which the police force can have in its enforcement of law and direction of traffic, is a system of signs adequate in number and correct in design. Traffic needs have resulted in the development of a multitude of devices. There is no phase of traffic work in which so wide a variation of practice is found in different cities. Indeed within the same city it is not uncommon to see as many as five or ten different types of signs, on the same street, varying in size, color, and printing. In this variety there is probably no one type which would answer perfectly the need of all communities. A consideration of the purposes for which signs are erected and the conditions under which they are used, however, makes possible certain conclusions regarding the designing of proper signs.

No matter how simple are the local traffic rules, all of the provisions cannot be carried in mind by the users of the streets. The chief purpose of the sign is to apply the text of the regulation at the special point where it is needed. For this reason signs

should be used freely, and should be placed especially at those places where a violation of the law may result in danger. With an adequate system of signs law enforcement and direction is made much simpler.

Under most conditions a sign must carry its message to the driver while he is under way. For this reason the sign must be distinctive; possess a high degree of visibility, and be simple in its wording. The distinctiveness of the sign depends largely on its shape and color. When a shape for the traffic signs has been selected an ordinance should prohibit the use of signs of this shape for other purposes. In a number of cities advertisers have imitated the shape of traffic signs and have thus greatly lessened their effectiveness. The color for the signs should be chosen for its distinctiveness as well as for its visibility. The Committee on Construction and Engineering of the Department of Commerce Conference on Street and Highway Safety, recommends that signs should have the following colors:

Red background, white letters or symbols, to indicate "Stop." Green background, white letters or symbols, to indicate "Proceed." Yellow background, black letters or symbols to indicate "Caution." Purple background, white letters or symbols to indicate "Crossroads." Distance and direction signs should be black and white.[1]

The fact that the traffic signs must usually be read while the reader is moving further makes it desirable that their message be given in the simplest possible terms. Some attempt has been made in this country to design graphic signs which will convey information by the use of symbols and without the use of words. Graphic signs have been used generally in France where a code of symbols has been devised for the entire country. The most successful system of this kind to be developed in America is that of the International Association of Chief of Police. The signs proposed by this organization are all in the shape of arrows. The direction of the arrow, and its manner of mounting, together with simple printing, are thought to be adequate to direct drivers. One of the chief advantages of these signs lies in the fact that they are sufficiently distinctive in shape so that they will not be confused with other signs.

[1] *Report*, Washington, 1924.

A limitation of practically all types of traffic signs is that they are not visible at night, and that this is the period of the day when directions and warnings are most needed. To meet this need various types of illuminated signs have been devised. The traffic beacon or flashing sign is one of the most interesting. This sign, illuminated by electricity or gas, flashes intermittently through lenses of yellow, green or red, according to the location of the signal and the conditions which it marks. Some types of lighted signs have illuminated lettering as well as colored lenses. The obvious advantage of the flashing sign is that it has a high attention value, and that it does not become confused with fixed lights on the streets.

The necessity for a standardization of signs throughout the country is becoming imperative with the growth of interurban and interstate automobile travel. As in connection with hand signals and the more fundamental laws of the road, so with signs; a motorist should be able to understand the local directions no matter from what part of the country he comes.

As has been indicated there is probably no one type of sign which is best or entirely satisfactory for all conditions. As a possible basis for standardization, however, the writer wishes to call attention to the type of signs designed and erected by the Automobile Club of Southern California. These signs are generally used on the Pacific coast, and with them three transcontinental trails have been marked. They are known to a larger number of drivers than any other single type. Simplicity is their chief merit. The directions are clear, the lettering plain, and there has been a satisfactory use of symbols. The signs vary in size from 18 to 20 inches square, are made of heavy sheet metal, and are solidly mounted on a pipe standard.

Too frequently the duty of erecting signs is not definitely placed in the city. Inasmuch as signs serve as a means of assisting the police in the enforcement of law, it would seem logical to vest the responsibility for the erection and maintenance of signs in the police department, to be exercised through the traffic bureau. In the larger cities it will be found desirable to assign special employees of the department to this duty. In Detroit, the Commissioner of Police is given the authority to erect signs and "limit markers," and it is further provided that no rule or regulation shall become enforceable until such time as a sign or signs, "sufficient in number to apprise an ordinarily

observant person of the existence of the rule or regulation upon the street or district affected," shall have been erected. And it is further provided that, "A rule shall not be enforceable against an alleged violator if, at the time of alleged violation, the sign, standard or limit line, evidencing the existence of such rule, was missing, effaced, or mutilated."[1] The police are charged, in addition, with the immediate removal of signs when a regulation which they evidence has been revoked. This definite placing of responsibility over signs, together with the liberal appropriations which have been made for the purchase and manufacture of signs, are the chief causes for the excellent sign system in Detroit.

In both Detroit and Philadelphia practically all of the signs erected for traffic direction are manufactured under the supervision of the traffic bureau in a paint and sign shop established for this special purpose. This practice has made it possible to have signs available at all times for the enforcement of rules, and has made the replacement of mutilated signs more speedy. The cost of signs has also been lowered considerably. In the Detroit sign shop from 100 to 150 signs per day can be made. A stenciling process is used and the estimated cost of erected signs has been reduced from $2.50 per sign to 90 cents. The men assigned to the paint shop also have charge of placing paint markers upon the streets and keeping them in repair.[2]

A similar sign shop has been installed in Philadelphia in connection with the traffic division. Ten men are employed at this work, and the annual appropriation for materials is approximately $7,000 per year. In addition to the manufacture of traffic signs this shop also makes the semaphores and electrical signaling devices used by the traffic police. About 60 per cent of the material used in the manufacture of signs is salvaged from the waste of other city departments. For example, old automobile

[1] *Detroit Street Traffic Ordinance* part 1, secs. 8 and 9, 2nd ed., 1920.

[2] For this information the writer is indebted to Robert Dreaver, officer in charge of the shop.

rims are used for forms for casting sign supports, old pipe for uprights, and discarded metal for the faces of the signs.[1]

Paint Markings.—The use of paint markings placed on the road surface is a practice which has been noted in practically all of the larger cities. Police officials are almost unanimous in their approval of this type of directing device. There are two general types of painted direction: the simple paint line indicating a limit, direction, or division of traffic movement; and the painted lettered sign.

The chief difficulty experienced thus far with pavement markings is that they lack permanence. As yet no paint has been discovered which will remain clear for more than a short period

[1] The following table shows the Philadelphia experience. The author is indebted to Captain Harry Shultz for these data.

Dimensions	Type and lettering	Number mfg.	Cost
12 inches round, 2 sides..	"No Parking," 8:30 a. m. to 6 p. m.	300	$ 7.80
12 inches round, 2 sides..	"No Parking"	100	$ 8.00
12 inches round, 2 sides..	"No Parking," 4:30 p. m. to 6 p. m.	150	$ 7.80
12 inches round, 2 sides..	"Parking Permitted" 1 hour etc.	150	$ 7.80
12 inches round, 2 sides..	"No Parking, Load and Unload Only"	100	$ 7.80
⅛ × 12 × 18 inches, 2 sides.....	Various limits	200	$ 5.97
⅛ × 12 × 18 inches, 2 sides.....	Fire Station Signs	100	$ 6.47
⅛ × 12 × 18 inches, 1 side.....	"Traffic Control"	200	$ 5.02
⅛ × 12 × 18 inches, 1 side.....	"No Parking—Place of Amusement"	500	$ 5.57
⅛ × 12 × 18 inches, 1 side.....	"One-way Street"	50	$ 6.37
8 inches round, 2 sides...	"Safety Zone"	300	$ 7.90
21 inches round, 2 sides..	"Safety Zone"	50	$ 14.75
Single-type semaphores.....		150	$ 15.00
Special three-wing semaphores.....		15	$ 70.00
Electric semaphores.....		15	$125.00
Special banjo semaphores.....		2	$ 16.00

of time where there is heavy traffic. As the line wears away it soon loses its authority and power of suggestion. If pavement signs are to be of value they must be renewed frequently. A number of cities have adopted machines for the placing of paint lines, thus reducing the cost of frequent renewals. In other cities cement blocks, bricks, and cut stone of a different color than the paving material have been set into the pavement, in lieu of paint lines.

Some of the uses to which paint lines have been put with success, follow: safety zones at car stops; crosswalks at street intersections; signs showing speed limits; warnings regarding

FIG. 24.—Paint line crosswalk, Washington.

dangerous curves and intersections; one-way street prohibitions; divison of traffic into lanes on busy streets; school zones; segregation of fast- and slow-moving traffic; indication of parking and ranking spaces and the designation of boulevard stop streets. In Los Angeles paint lines of different colors are used to indicate regulations regarding stopping and parking, a red curb indicating a place where standing is prohibited, and a yellow curb a place where standing for loading only is permitted. Recommendations recently made also call for the marking of business districts where special rules for driving prevail by the placing of a green line along the center of the roadway.

Similar to the paint line in effect and often used in conjunction with it is the mushroom or traffic button. This device is found in different forms but it is usually round, flush with the street surface at the edges, and with an elevation of from 4 to 10 inches at the center. The mushroom is used to mark the center of intersections, to divide traffic at intersections, and to mark the limit of safety zones. These mushroom buttons are more permanent than paint lines and are more effective in that drivers hesitate to pass over them. They tend to create a hazard, however, for vehicles are often thrown out of control in accidentally striking the higher types. Unless these markers are lighted, as some types are by an enclosed electric light, only the flatter forms should be used.

Traffic Signals.—In addition to traffic signs which merely set forth the provisions of the local regulations, there has been developed a large number of traffic signals, which operated automatically or manually, are supposed to assist in the direction of traffic.

The manual *semaphore* was one of the first devices of this type to be adopted by the traffic police, and it is now widely used throughout the country. There are many different types. Some are similar to the semaphores used in railway practice with arms which move up and down at right angles to the traffic which they control. Others have blades fixed in a horizontal position at the top of a support in such a manner that they can be rotated by the officer. Yet others are in the form of a large umbrella which can be rotated by the officer in such a manner that the words *Stop* and *Go* printed on the outside will be turned toward the various parts of the intersection. In addition to the arms, blades, and printing, some types of semaphore are provided with colored lights to increase their effectiveness at night. All types are similar in that they attempt to increase the effectiveness of the officer's signals. That a well-designed semaphore is able to give a better and more understandable signal than that given by many officers today is certain. That they always offer a better means of signaling than that possessed by an officer who has been properly trained in the making of arm signals is to be doubted. All semaphores, moreover, possess certain disadvantages. The area of the intersection is restricted by an obstacle which cannot be moved readily for unusual demands such as the passage of fire apparatus or the turning of large trucks. The

officer is restricted to a certain spot in the intersection whereas for most effective regulation he must often move from place to place. Finally, where semaphores are used it has been observed that the control of traffic tends to become passive, and that the officers fail to show the same alertness and energy as in strict manual signaling. Semaphores can be used to advantage, however, on broad streets; in places where gradients or obstructions make it difficult for drivers to see the officer, and in situa-

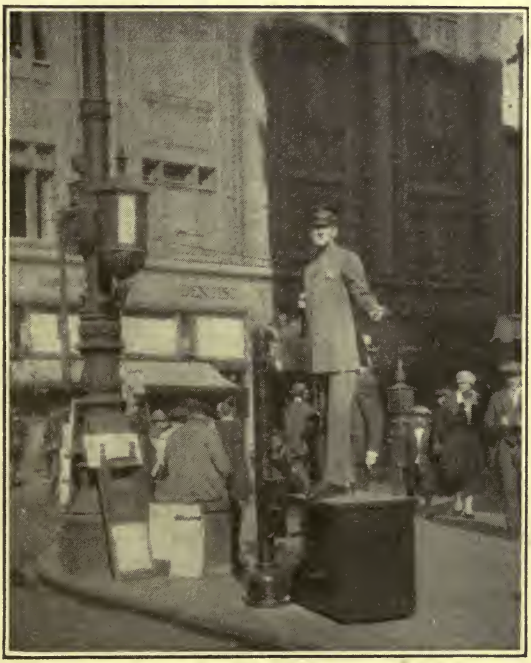

FIG. 25.—A manually controlled electric signal, San Francisco.

tions where it may appear desirable to coordinate the control at several intersections.

The signal light for traffic control has been adopted from railway practice. All traffic signal lights depend chiefly upon colors to carry their commands, though some use lettering in conjunction. With the increased use of these lights it is very desirable that some standard color system should be adopted. The most widely used code, and one against which no very

serious objections can be raised, is that which uses red as the stop command; green for release; and yellow for caution.[1] At busy intersections where pedestrian movement is so great that a special time interval must be arranged for its passage, the yellow light is used for the purpose. These signal colors correspond to general railway practice, and with the exception of the Fifth Avenue system, have been adopted by all of the more important synchronized systems.

A variety of methods has been used for the mounting of signal lights. In some cases they are mounted on posts at the curbing, or on brackets which carry the light out over the roadway; in other cases they are suspended over the roadway by wires; and in yet other cases they are mounted on posts or towers in the center of the intersection.[2] No one plan will work best under all conditions, but it is believed that for most situations the mounting which makes it possible to suspend the signals over the center of the intersection is most desirable. This plan keeps the street free from surface obstructions; puts the signal in the location toward which drivers are accustomed to look for directions, and finally makes it possible at simple intersections for one mechanism to signal all traffic.

The signal lights may be operated manually or automatically. In Detroit, New York, Baltimore, and Pittsburgh the former method is used, while in Chicago and Los Angeles automatic control is used. The manual control appears under general conditions, to be the more desirable. It is less expensive to install, more certain in its functioning, and more flexible in its adjustment to changing traffic needs.

It has been pointed out that a system which depends entirely upon colors for control is of no value to the color-blind driver. In order to overcome this defect it has been proposed that

[1] Recently there has been considerable agitation against the use of red lights for any street traffic purposes, it being claimed that this color should be reserved for the indication of the more important types of fixed dangers. Its meaning for signals is now so thoroughly understood, however, that the utility of a change is to be doubted.

[2] See chap. VIII for a discussion of the operation, merits, and defects of the synchronized light control system.

position lights be used.[1] This system is now used by a number of railroads. For the semaphores and colored lights there has been substituted a signal which consists of a disk on which are placed seven clear lenses, three of which can be lighted at a time, giving a horizontal, vertical, or diagonal row, corresponding to the positions formerly taken by the semaphore arm. The system is simple in operation and the public could soon be educated in the meaning of the different signals.

[1] McIntyre, Professor L. W., quoted in the *San Francisco Municipal Journal*, p. 226, July 12, 1923.

The following table indicates *typical signal practice* in the larger American cities.

City	Manual semaphores	Manual lights	Automatic lights	Signal towers
Baltimore	Yes	Yes	Yes	Yes
Boston	Yes	No	Yes	No
Cleveland	Yes	No	No	No
Chicago	No	No	Yes	Yes
Detroit	Yes	Yes	Yes	Yes
Kansas City	No	No	No	No
Los Angeles	No	No	Yes	No
Philadelphia	Yes	Yes	No	No
Pittsburgh	Yes	Yes	No	No
Portland, Ore	Yes	No	No	No
St. Louis	No	No	Yes	No
San Francisco	No	Yes	No	No
Washington, D. C	Yes	Yes	Yes	No

CHAPTER XIV

THE TREATMENT OF OFFENDERS

In no phase of traffic regulation is greater variation among the different cities of the country to be found than in methods of dealing with offenders. Offenses which are rigidly punished in one city do not even warrant an arrest in a neighboring community. There, moreover, is no aspect of the administration of local justice which has caused more general dissatisfaction than that which deals with the punishment of violators of the local traffic laws.

Classification of Offenders.—One of the most valid causes for complaint is to be found in the failure of the police to make a reasonable classification of offenders. There is clearly no need to subject the violator of a parking regulation to the same degree of humiliation and inconvenience which would be warranted in the case of an intoxicated or reckless driver. A reasonable distinction in the treatment of different offenses will save the public from much unnecessary annoyance, and the police and the courts from much labor.

The following classification is proposed as one which has proved workable:

Class One.—Where there is a minor infraction of a provision of the traffic code, and there is clear evidence that the violator has not wilfully nor intentionally broken the law, the officer should caution the offender and instruct him as to the provisions of the law governing the act. The officer's duty will be simplified if he is provided with copies of a digest of the local law which can be handed to the offending driver or pedestrian.

Class Two.—Where there is clear evidence that the infraction of the law is knowingly or carelessly committed, as in passing through a clearly marked safety zone, or making a turn against the orders of the intersection officer, the offender should be required to appear at traffic headquarters. Here the name and address, and the details of the offense should be filed for reference. The offender should be cautioned, and instructed regarding the law covering the offense. In case the offense is repeated, the violator should be dealt with as in class three.

Class Three.—Where the violation is clearly the result of wilful recklessness, and seriously endangers the life and property of other users of the street, the offender should be immediately arrested and formally booked at the nearest police station.[1]

The chief difficulty in the use of such a classification as the above lies in the fact that it necessitates the use of considerable discretion on the part of the police officer. Whether this discretion will be used in a satisfactory manner depends partially on the knowledge which the officer has of his work, and more directly upon his honesty.

The Danger of Graft and Discrimination.—It may not be amiss at this point to state that the most serious charge which is today brought against the system of traffic law enforcement is that the police make unfair discrimination between different users of the streets. In practically all of the larger American cities the writer has heard both general and specific charges that for reasons of race, religion, friendship, politics, or simple bribery, traffic police and the officials of traffic bureaus permit many persons to violate the law with immunity, while others, not so favored, are punished for the same offenses. Business men and officials of importance, it is said, may drive at an illegal rate of speed, pass by signals, and park their cars for any length of time they please, without fear of arrest. Such charges are much easier to make than they are to prove. It is probable that they are considerably exaggerated, but they are certainly not entirely without foundation. Occasionally the cause of discrimination is to be found in an improper sense of duty and honesty possessed by the enforcing officer. More frequently it is believed that it results from the laxness or dishonesty of the higher officials. The director of a traffic bureau who, at the behest of local politicians, instructs his men to treat certain individuals easily, or who personally destroys reports of offenses, or in other ways interferes with action against violators, can scarcely expect that a

[1] Chief O'Brien, *Transaction of the Commonwealth Club of San Francisco*, p. 28, vol. 17, 1. Also see *Report of the Commissioner of Motor Vehicles*, p. 23, Hartford, Connecticut, 1922. "It has always been the test for the Department of Motor Vehicles that determination . . . as to whether punishment be imposed, depends upon whether there is wilful intent in any offense. Wilful intent may be actual or presumed for this application . . . Whenever the person offending operates in so careless or improper a manner that it is fair to assume negligence, the presumption of intent ought to lie, and that person ought to be punished."

greater degree of honesty will be found in his subordinates. The situation to be seen in many cities where expensive cars are permitted to move at will, with or against directions, while the drivers of inexpensive cars are held rigidly to the regulations, is not one to inspire the general public with a deep desire to cooperate with the police.

Summary Arrests and Arrests by Summons.—As has been pointed out the officer who observes a minor infraction of the law should deal with the case in person, but where the offense is more serious the central bureau or courts should use their discretion. There are two ways in which the officer may deal with this latter class of offenders—an immediate arrest can be made, or a summons can be issued. The summary arrest should not be used except in aggravated cases. It should be reserved for the class of offenders who through wilful recklessness endanger the lives and property of other users of the street, and whose liberty would constitute a continuing hazard. Thus, for example, those who are driving under the influence of liquor should be taken into custody immediately. For the greater number of offenses, however, the formal arrest is undesirable. It makes it necessary for the officer to leave his post and accompany the offender to the station, or call another officer for the purpose. During his absence a score of similar violations may be committed, and traffic may become severely tangled. The formal arrest, moreover, causes unnecessary delay and humiliation to the milder offender. When a prisoner is taken to the station his name and the particulars of the case are entered on the blotter, he is searched and his valuables are removed, and unless bail is furnished he is incarcerated. For most cases the summons serves the purpose of insuring the presence of the offender. Summons forms are prepared and signed in blank by the proper official. The traffic officer makes out the summons in duplicate, giving the original to the offender and filing the copy with the desk man at headquarters. In case the violator fails to appear at the specified time and place it is a simple matter to issue a warrant for his arrest.

Dealing with Offenders at the Traffic Bureau.—Whether the summons should be returnable to the traffic bureau headquarters or to the municipal police courts will depend upon the character of the offense and the procedure in the locality. A properly organized bureau will be able to deal effectively with the greater

number of the cases arising. The amount of relief which can be afforded the courts by a summary hearing at the traffic bureau is indicated by the fact that during the year 1922, the Department of Public Safety in Philadelphia, heard and disposed of 6,960 cases. Of this number 258 failed to return the summons, and were arrested upon warrant. Of the number appearing seventy-five were held for court.

The duty of dealing with those who appear at the bureau should be given to an experienced officer who is thoroughly familiar with the traffic regulations of the community, and who has shown his ability to do this type of work effectively. The purpose of the interview should be to inform the offender about the local regulations, to point out the dangers of improper driving, and to give him a desire to assist the police in law enforcement. Both the rough disciplinarian and the officer who treats his task lightly are unsuited for this duty.

In some cities a standard scale of fines has been devised, and offenders who appear before the bureau are required to pay a penalty. Thus in Detroit in connection with the impounding law, the bureau collects fines varying in amount according to whether the offense is the first, second, or third. The practice followed in at least one city, whereby those who are summoned to the bureau are required to deposit a bail, varying in size according to the character of the offense, and are then advised to forfeit their bail instead of appearing in court, is undesirable, as it tends to give the public an improper respect for the law enforcing agencies.

THE COURTS

The question arises as to the most effective manner of dealing with those offenders who are summoned to appear before a magistrate. In many cities present conditions are such that the ends of justice are frustrated and the courts are held in disrepute. The courts as well as the police are frequently charged with gross favoritism, charges which are too frequently justified by the improper attitude of the judges toward their duties. More often, however, discrimination and inequality in court action are due to the fact that there is no definite and well-organized procedure for traffic cases. The general practice is to put the traffic cases on the calendar with other cases coming before the police judges. The calenders of such courts are

usually so filled that traffic cases, often being of minor importance, are given but a summary hearing. Where several different police judges are dealing with traffic cases at the same time one may be very lax in the penalties which he imposes while another may be very severe. Even within the same court on the same day a situation has been observed where for the same offense one man was left off with a warning while another was given 10 days in the work house. Such conditions naturally lead to a feeling that injustice has been done and that the laws are a farce.

Special Traffic Courts.—In a number of cities a great improvement has been brought about in the handling of traffic cases by the institution of traffic courts which deal solely with violations against the local regulations and the provisions of the State Motor Vehicle Act. In the smaller communities, where there are but few traffic cases, the traffic court is established, by holding a special session in one of the regular courts on a certain day each week, the remaining time of the judge being taken up with the general duties of a police magistrate. In larger cities where there are many traffic cases it is desirable that the full time of one or more judges be given to this work.

Where traffic courts have been established (New York, Baltimore, Philadelphia, Pittsburgh, Cleveland, Detroit, and Chicago, among others), it is the universal opinion that cases are handled in a much more satisfactory manner. A judge assigned to full time duty in a traffic court has an opportunity to give his entire attention to matters concerning these cases. Considering the growing complexity of both local and state vehicle laws such attention is needed if the cases are to be correctly understood. The judging of traffic cases requires, moreover, something in addition to a comprehensive knowledge of the law. The magistrate must have considerable knowledge of the operation, and the capacities and limitations of motor vehicles, if he is to weigh the facts justly. This is a specialized type of knowledge which cannot be acquired without some extended experience.

Long practice in dealing with traffic cases makes it possible for a judge to develop a special kind of technique and procedure. In one city, for example, a traffic judge has devised a system of diagrams and models, representing typical street intersections, and various types of vehicles. By the use of these it is possible for a witness of limited ability to make his testimony clear.

The traffic judge becomes familiar with the members of the traffic squad and such knowledge assists him in understanding and weighing the evidence which they introduce. The *repeater* or frequent offender also becomes known to the judge, and he can distribute justice according to the merits of the case. Where regular traffic courts have been established fuller and more accurate records are kept of the offenders and the penalties levied. Greater use is also made of information which has been collected by the police department concerning past offenses of defendants. In one city, for example, the chief of the Accident Investigation Bureau regularly sits with the traffic judge and produces the offenders record, if there be any, before the case is heard.

In addition to the judge who is assigned to traffic work, it is desirable that a special police prosecutor should be assigned to traffic cases where they are numerous. In this manner the prosecutor as well as the judge will profit from the experience which comes from handling a large number of cases of the same character.

Penalties.—The question arises as to whether the penalties which are levied on traffic offenders are sufficiently heavy? With the record of accidents and deaths on the street constantly increasing it is frequently suggested that recklessness could be stamped out by the imposition of heavy fines and the use of the jail sentence. Twelve police officials in charge of traffic bureaus have been asked if they believe that heavier penalties would assist them in law enforcement. One answered in the negative while all the others replied in the affirmative.[1]

[1] Some idea of the character of typical penalties is obtained from the following table compiled from data taken from the *Annual Report of the City Magistrates' Courts*, p. 161, New York City, 1921.

Offenses	Total	$1	$2	$3	$5	$10	$25	$50	Jail
Driving left	3,171	623	986	601	620	293	.....	.....	49
Passing street cars	495	.....	.....	.....	.....	...	399	.....	83
Recklessness	122	.....	.....	.....	.....	...	56	35	26
Speeding	9,615	.....	.....	.....	.....	...	7,116	1,546	817
Minor	18,093	4,738	6,854	4,100	1,704	590	1		

With the development of traffic court procedure various types of new penalties have been advocated. The money *fine* is still the most prevalent by far, but there is a growing feeling that even the heaviest fines do not serve as a sufficient deterrent to certain classes of offenders. The character of the fine varies in different communities; in some the minimum is $1, while in others the lowest fine which can be levied is $10. Maximum fines vary from $25 to $500.

The *jail sentence* is gaining in favor in many cities. It is claimed that where it is used there is much greater care in driving and that this additional caution is reflected in fewer accidents and deaths on the streets. It is said, moreover, that the jail sentence has reduced the number of second offenders. Driving while under the influence of liquor, and similar forms of recklessness are now generally punishable by a jail sentence.

Another penalty which is growing in favor is the *impounding* of the offender's vehicle. This penalty is said to be very effective for it deprives the driver of an instrument which may be of considerable value to him in his business. In cases of young drivers and women offenders it appears to be a more desirable penalty than the jail sentence. Where the impounding penalty is enforced the court turns over the vehicle to the police department which stores it under bond until such time as the court gives an order for its release.[1]

Another proposed penalty is that the courts should be vested with authority to *suspend drivers' licenses.* The power of suspension is now generally lodged in the hands of the state commissioner of motor vehicles. In Connecticut the commissioner has been more active in this matter than in many states. "The department conducts hearings in the cities of the state and

[1] See *Transactions of the Commonwealth Club of San Francisco,* vol. 17, pp. 555–556, San Francisco, 1923, where provision is made in a model vehicle act for impounding as follows: ". . . the court may impound the motor vehicle driven by such person at the time of the violation of the said provisions of this act, provided such person is the registered owner of such motor vehicle, for a period not exceeding 60 days . . . In the event of the impounding of a motor vehicle as herein provided, the court may order the safekeeping of such motor vehicle into the custody of any persons, firm, or corporation operating a public automobile garage. The reasonable expense of storage and for the safekeeping and maintenance of such motor vehicle during the period for which it is impounded shall become a lien upon such motor vehicle."

assigns such requests for hearings as rapidly as they are received. Whenever a sufficient number are had in any locality, its hearing inspector goes to the central city or town and conducts the hearings and makes a determination on each. The Department always has in Hartford one or more officials empowered to hear cases so that any person may at any time have his case taken up and heard without delay.[1] There appears to be no valid reason why the power of suspension should not be exercised by the local courts. The motor vehicle department of the state could be notified of all suspensions, and no substitute license would be issued during the period specified by the court. In those states where a driver's license is required this penalty would be a very effective one, for without the license the driver could not legally operate a motor vehicle.

[1] *Report of the Commissioner of Motor Vehicles of Connecticut*, p. 29, Hartford, 1922.

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